

**AMMUNITION STORAGE**  
**Subcourse MM 2601**  
**Edition 8**

**United States Army Combined Arms Support Command**  
**Fort Lee, Virginia 23801-1809**

**8 Credit Hours**

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## INTRODUCTION

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As an ammunition specialist, you must maintain ammunition stocks during peacetime and support the use of ammunition during wartime. To do this, you must understand ammunition storage concepts and be able to perform the various ammunition storage operations. That is what will be covered in this subcourse, *Ammunition Storage*, which consists of five lessons designed to teach you how to store ammunition, how to rewarehouse and inventory ammunition, and how to complete the paperwork required in these operations. You will also learn how to select and use ammunition storage drawings.

In some overseas areas, the Army uses North Atlantic Treaty Organization (NATO) explosive standards. NATO standards may differ from the standards taught in this subcourse, but the basic rules for storing ammunition are very much alike.

### **Supplementary Requirements**

There are no supplementary requirements in material or personnel for this subcourse. You will need only this book and will work without supervision.

### **Credit Hours**

Eight credit hours will be awarded for the successful completion of this subcourse – a score of at least 70 on the end-of-subcourse examination.

Passing score for ACCP material is 70%.

**Lesson 1**  
**AMMUNITION STORAGE IN**  
**THE THEATER OF OPERATIONS**

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TASKS	This lesson is based on the following tasks from soldier's manual STP 9-55B12-SM: 093-400-1117, Determine Field Storage Categories for Ammunition, and 093-400-1153, Place Ammunition in Outdoor Storage.
OBJECTIVES	When you have completed this lesson, you should be able to describe the characteristics of ammunition storage sites in the theater of operations, describe field storage operations and procedures, and determine field storage categories for ammunition.
CONDITIONS	You will have this subcourse book and will work without supervision
STANDARD	You must score at least 70 on the end-of-subcourse examination, which covers this lesson and lessons 2, 3, 4, and 5.

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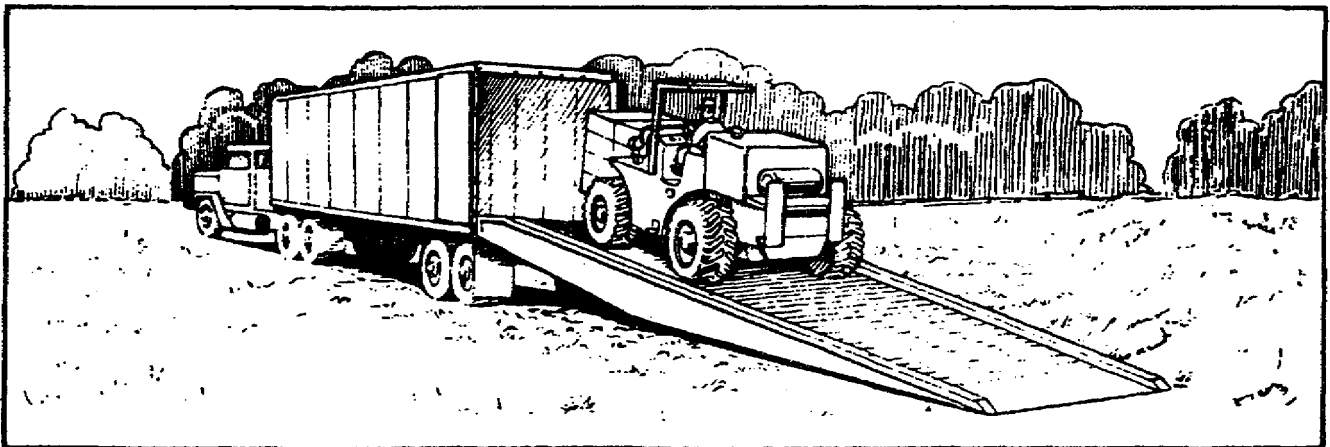
**TYPES OF STORAGE SITES**

Storage sites for ammunition in the theater of operations include ammunition supply points, ammunition transfer points, nuclear ammunition supply points, and ammunition prestock points.

**Ammunition Supply Points**

Ammunition supply points (ASPs) are for the storage of conventional ammunition. They are normally set up near the rear division boundary at a reasonable distance from the troops they support.

Ammunition is stored on the ground in ASPs. When it is received in a container, it is unloaded and the containers are released for reuse (Figure 1-1).



*Figure 1-1. Ammunition Being Unloaded from a Container at an ASP.*

## MM2601, Lesson I

**ASP Layout.** An ASP is laid out into several different areas to provide dispersion of stocks and to allow the receipt, issue, and inventory of ammunition in separate places at the same time. See Figure 1-2. The ideal layout shown in the illustration is not always possible. There may be personnel or equipment shortages, or the location itself may limit the size and number of areas possible. The major areas are described below.

- *Storage Area.* Area with several sections used to store ammunition stocks.
- *ASP Office.* Controls and accounts for ammunition; located close to the vehicle holding area.
- *Vehicle Holding Area.* Area where incoming vehicles are parked until paperwork is processed.
- *Vehicle Assembly Area.* Area near the ASP exit where convoy vehicles are parked until all vehicles are loaded.
- *Demolition Area.* Area used for the destruction of unserviceable ammunition.
- *Captured Ammunition Storage Area.* Area used for the storage of enemy ammunition until it can be analyzed by technical intelligence personnel or destroyed by explosive ordnance disposal.
- *Segregation Area.* Area normally used for the segregation of unit ammunition turned in to the ASP that may not be in original containers, may contain mixed lots, may be incompatible, or may be unserviceable.
- *Inert Salvage Area.* Area used for the storage of inert salvage material, such as: packing material, boxes, propelling-charge containers, eyebolt-lifting plugs, grommets, links, clips, cartridge cases, and brass from small arms ammunition.
- *Ammunition Sling-out Area.* Area that provides for resupply of ammunition by helicopter; located at least 550 meters from salvage and bivouac areas.
- *Surveillance Area.* Area used as the inspection and classification site for surveillance procedures.

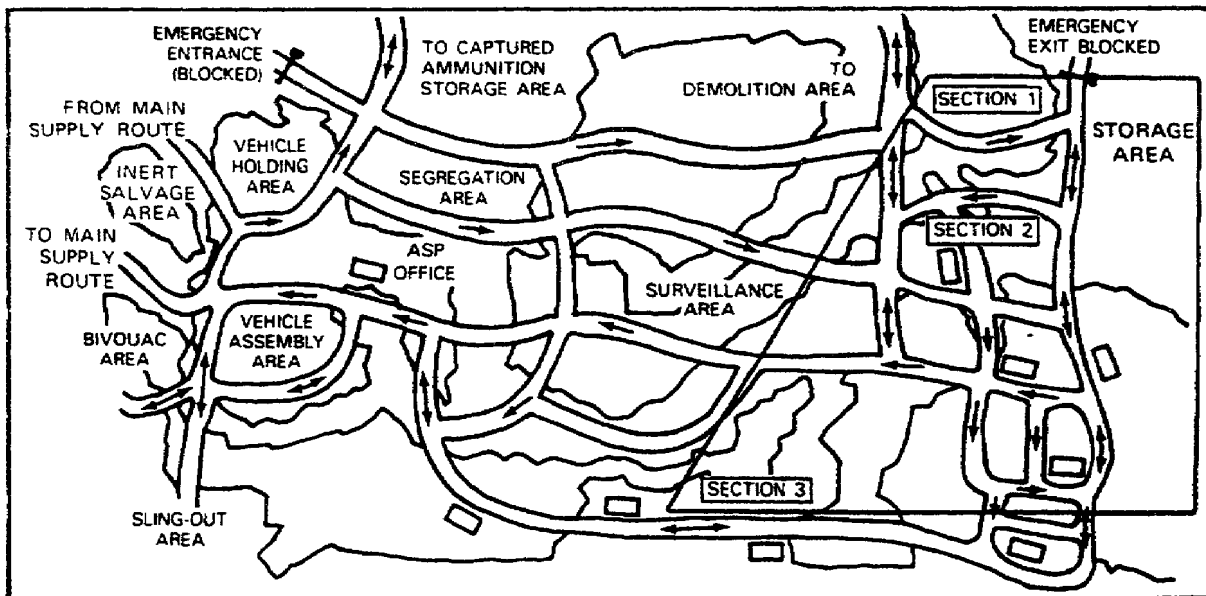


Figure 1-2. Layout of an Ammunition Supply Point.

**Forward ASPs.** Forward ASPs in a combat situation may be staffed by only one platoon of an ammunition company. In this case, the ASP would not have all the areas it would have in an ideal situation. It would probably have only one storage area section, a tent for an office, a vehicle holding area, and little more. A forward ASP may have an ammunition sling-out area if engineer support is available to help prepare the site.

**ASP Support Structure.** The ASP is the main source of ammunition for the division sector. Even though it is planned that ammunition transfer points will supply a large part of the high-demand munitions, the ASP will still be a viable part of the ammunition support structure.

The ASP normally stocks a three- to five-day resupply factor. This storage may vary according to the tactical situation. The direct support ammunition company under the TOE 9-64J 500 series has a lift capability of 2,200 short tons per day of break-bulk (noncontainerized) cargo. If the tonnage to be handled is 50 percent break-bulk and 50 percent containerized, the lift capability is reduced to 1,850 short tons per day. The direct support ammunition company has the capability to establish and operate two separate ASPs at a maximum separation of 20 kilometers. The lift capability would diminish at each location unless additional resources were added.

Ammunition is supplied to ASPs from the port of entry through the theater storage area (TSA) and the corps storage area (CSA) or throughput from the port or theater storage area directly (Figure 1-3).

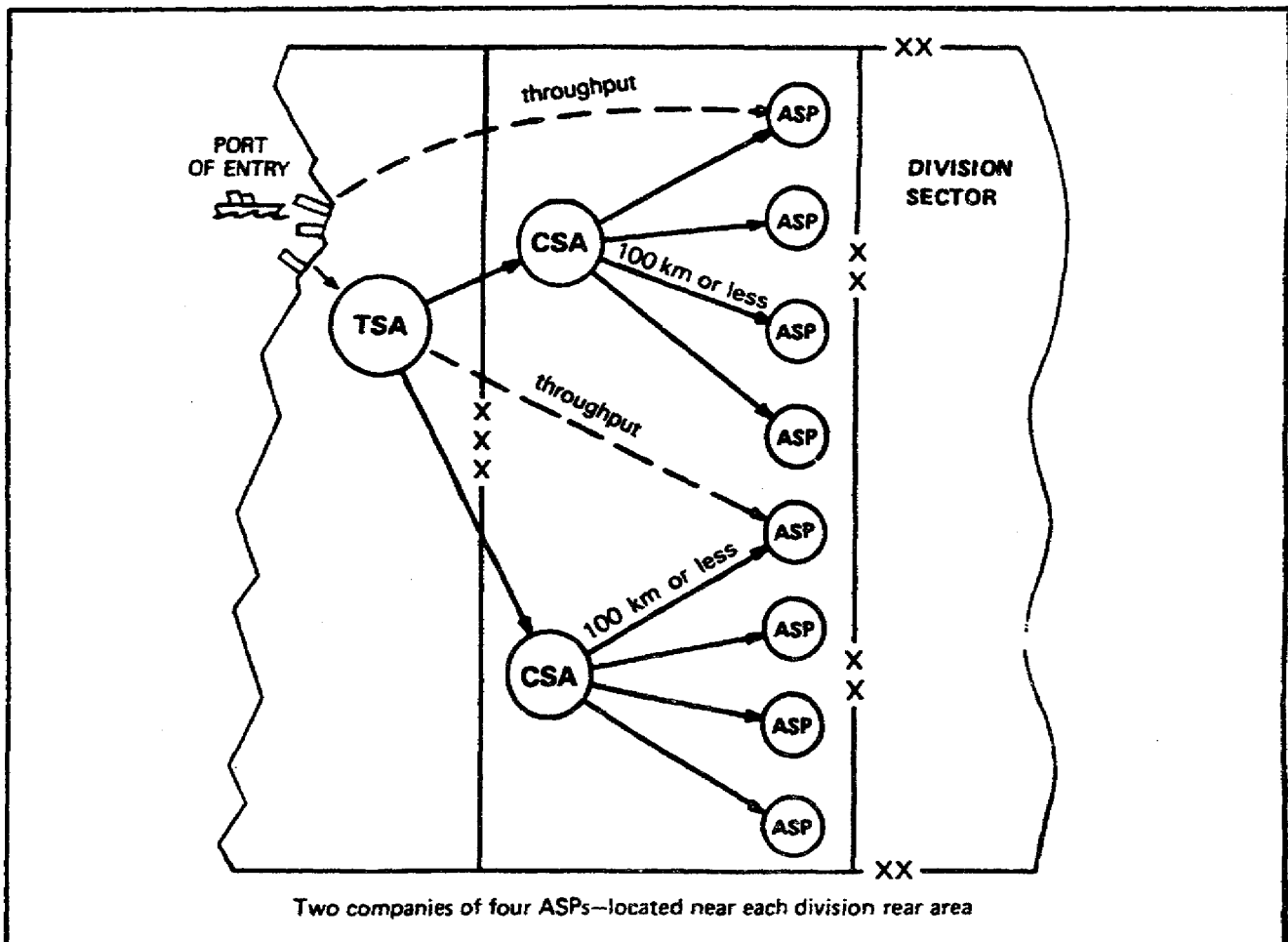


Figure 1-3. ASP Support Structure.

### Ammunition Transfer Points

Ammunition transfer points (ATPs) transload ammunition from large vehicles, usually stake and platform semitrailers, to brigade unit vehicles (Figure 1-4). According to present doctrine, no ammunition is stored on the ground.

The ATP does not reduce the mission of the ASPs. Divisional units still deal directly with the ASPs for a major share of their ammunition needs. The ATP is just a means of rapid resupply of those high-usage items that may be used quickly, such as 105mm or 120mm gun ammunition for divisional tank units, TOW missiles, and artillery ammunition.

**ATP Layout.** ATPs are set up in the brigade rear area for quick resupply of high-usage, high-tonnage items. The layout of an ATP is shown in Figure 1-5.

ATPs are an element of the division supply and service company of the supply and transport battalion. They operate under the control of the division ammunition office (DAO).

An ATP may require a trailer holding area. Then, if user vehicles are not at the ATP when loaded semitrailers arrive, the drivers may leave the trailers and return to the CSA. If there is a trailer holding area, a 5-ton or 10-ton tractor will be needed to move the trailers. Corps transportation must pick up empty trailers and return them to the CSA. An ATP has rough-terrain forklifts and cranes with operators. There is one noncommissioned officer in charge (NCOIC) per 12-hour shift, and an NCO from the DAO for accountability and control.

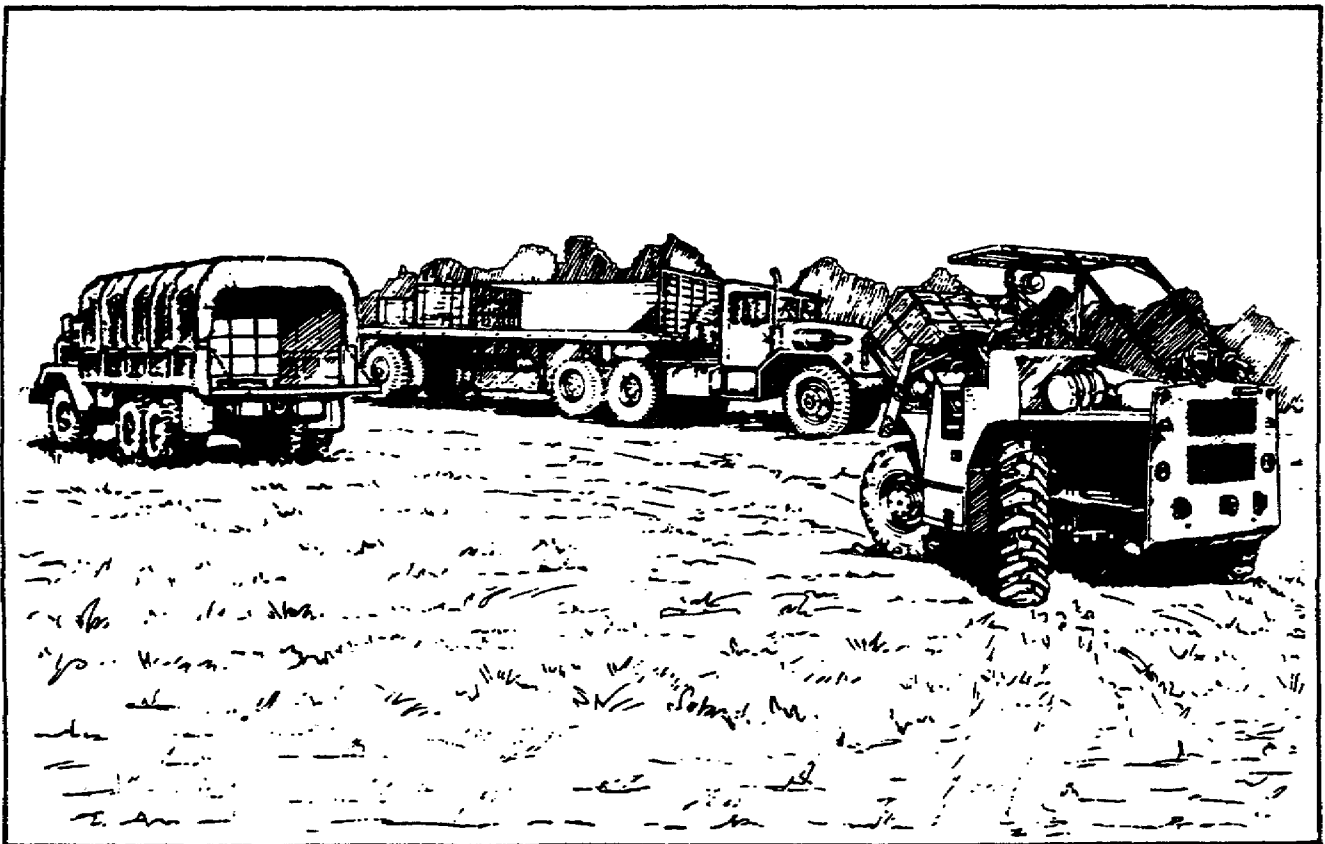


Figure 1-4. Transshipping Ammunition at an Ammunition Transfer Point.

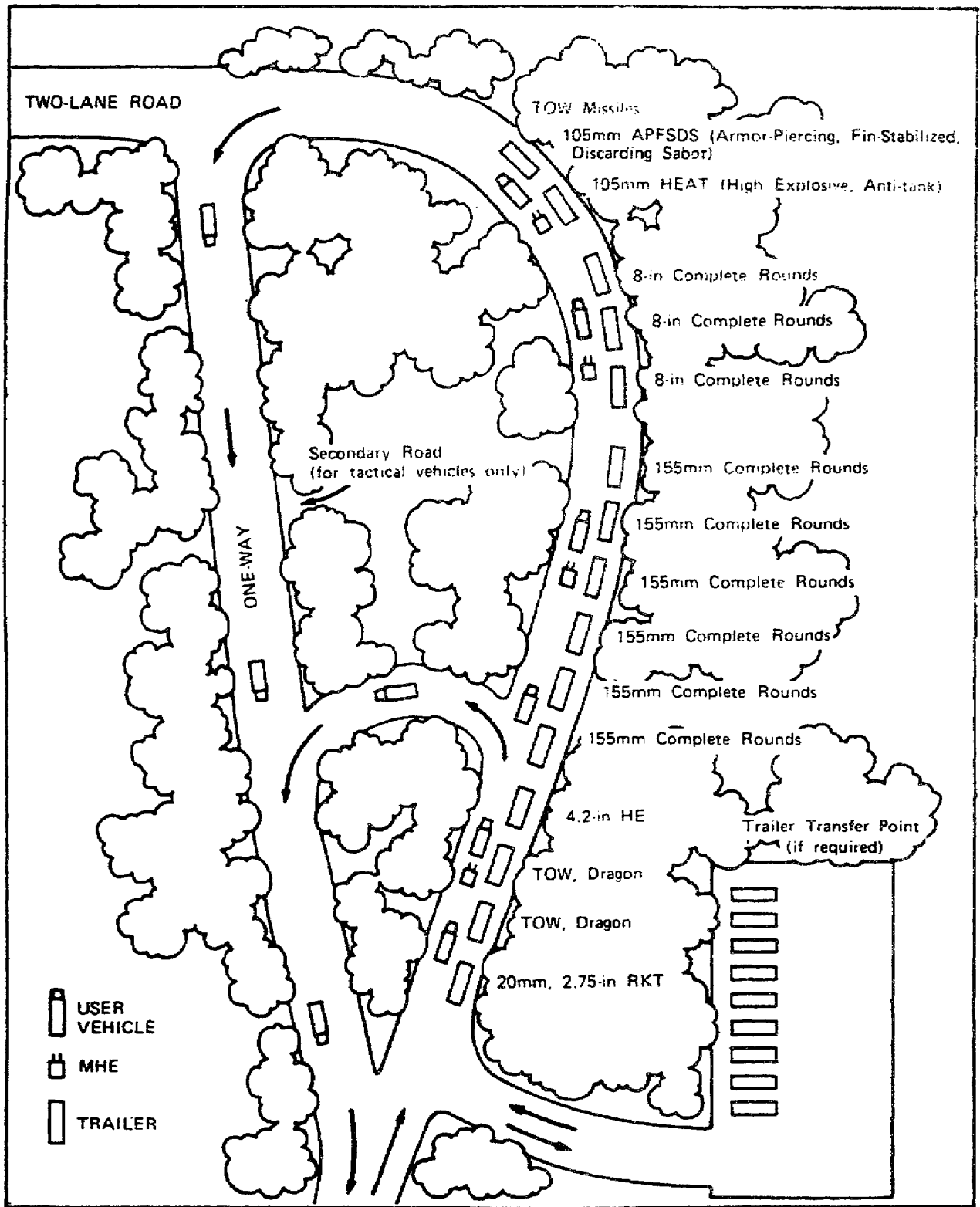


Figure 1-5. Layout of an Ammunition Transfer Point.



**ATP Support Structure.** Ammunition is sent to ATPs straight from the CSA by throughput distribution, but some resupply will come from support ASPs (Figure 1-6). There may be times when enemy action, the weather, or other obstacles stop or slow the normal resupply to the ATPs from the CSA, so each ATP has a support ASP for resupply. Some 80 percent of ATP stocks come from the CSA, and the remaining 20 percent come from the ASPs. ASPs do not deliver; either division or corps transportation must be used to draw ammunition from an ASP to an ATP.

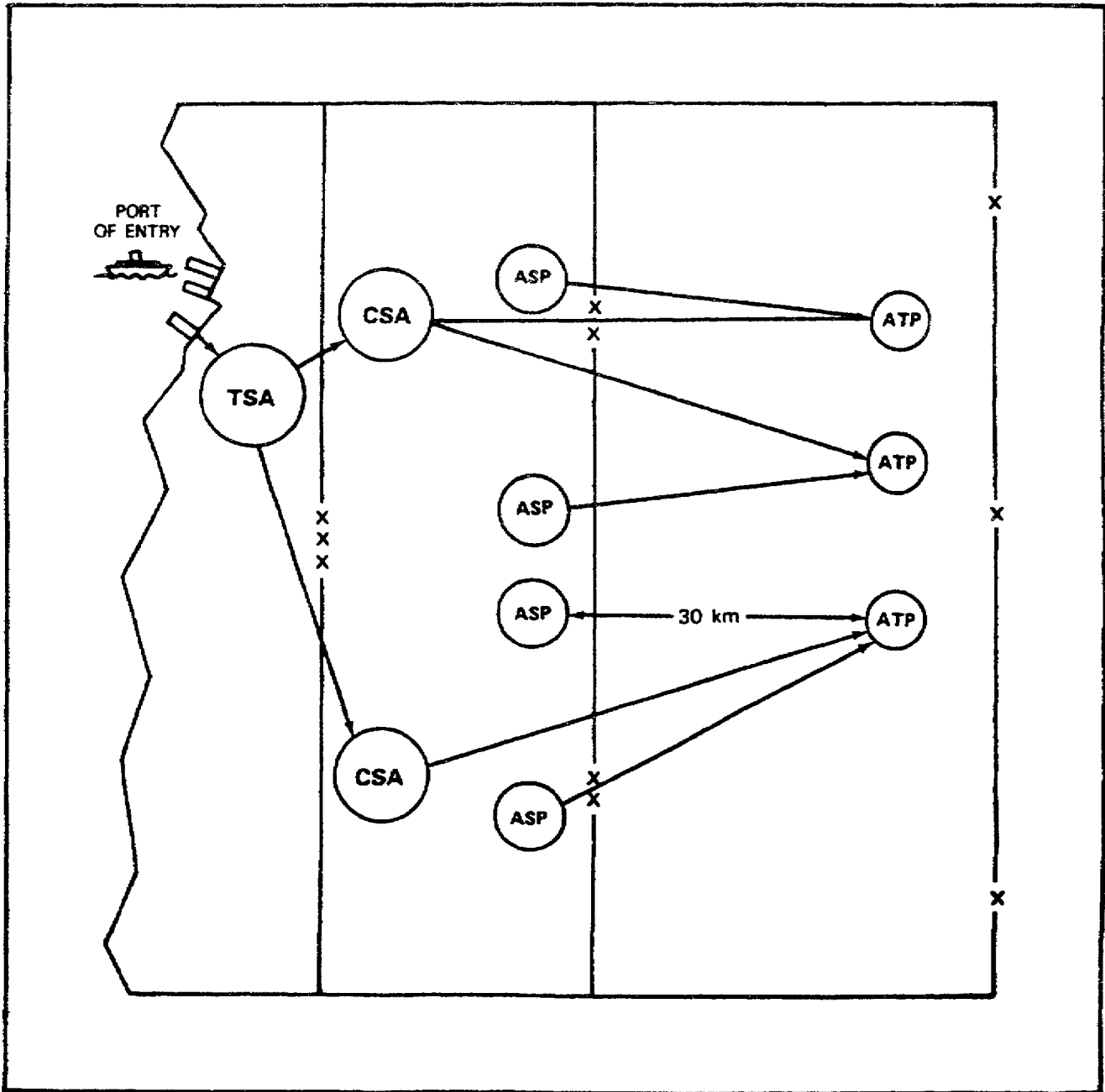


Figure 1-6. Ammunition Transfer Point Support Structure.

### Nuclear Ammunition Supply Points

Nuclear ammunition supply points (NASPs) are provided by nuclear ammunition companies. Each company deploys two NASPs to support division requirements. NASPs are completely mobile and must be able to move at least once every 24 hours. NASPs must secure, transport, store, issue, and maintain nuclear ammunition through the general support level. They also provide evacuation channels for nuclear ammunition and high-cost, low-density missiles.

### Ammunition Prestock Points

Ammunition prestock points are used in some overseas areas for the storage of basic loads and pre-positioned war reserve (PPWR) ammunition. A basic load for a combat unit is that amount of ammunition normally carried on unit vehicles in the event of war. The wear and tear on both vehicles and ammunition in such an arrangement presents undesirable situations. For example, an artillery unit 5-ton truck loaded with 155mm projectiles, propelling charges, and fuzes would have to be off-loaded every time the vehicle needed more than first echelon or driver's maintenance. In addition, the unit loses the services of the vehicle for other missions that might call for its use because it is always loaded and parked.

Establishment of prestock points solves this problem to a major degree. Not only basic loads, but a quick resupply of ammunition are available from prestock points in the event of war. Earth-covered magazines offer the best ammunition storage conditions and may be concealed, so these storage structures are in common use as prestock points (Figure 1-7). Above-ground magazines and outdoor storage are also used.

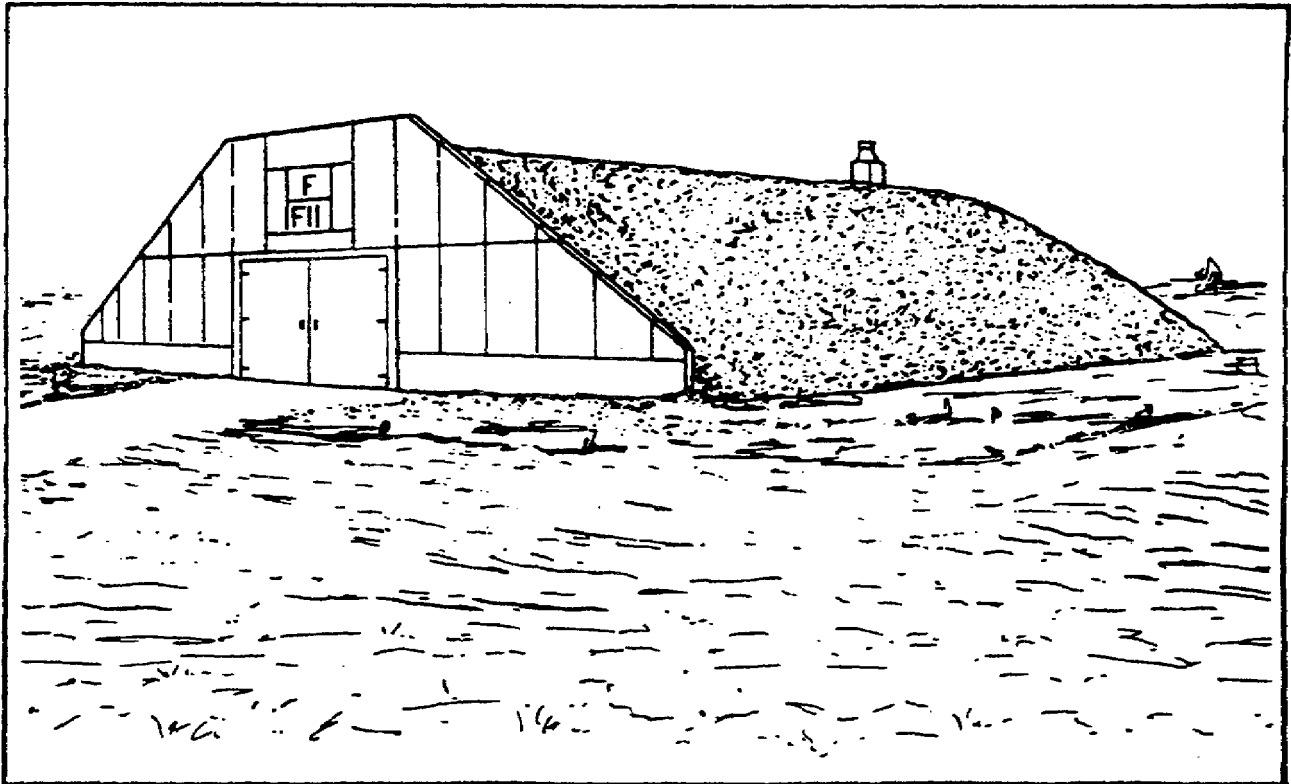


Figure 1-7. Earth-covered Magazine Prestock Point.

## OUTDOOR STORAGE SYSTEMS

There are four systems used for the outdoor storage of ammunition: area storage, roadside storage, area and roadside combination storage, and modular storage.

### Area Storage

In area storage, ammunition stacks are arranged in checkerboard fashion and spaced according to quantity-distance (QD) requirements (Figure 1-8). The advantage of area storage is that it provides the most efficient use of the area available. Its disadvantages are that it requires high, dry ground and that conveyors and materials handling equipment (MHE) must be used for loading and unloading operations.

### Roadside Storage

Roadside storage is the storage of ammunition and explosives along the edges of roads. The stacks are placed to comply with QD standards. See Figure 1-9. Storage in depth (some stacks are further from the road) gives the maximum storage per mile of road, but this type of storage requires roller conveyors and MHE (forklifts or cranes). The advantages of roadside storage are that stacks are accessible to vehicles and MHE, and less engineer support is required. Disadvantages are that high, dry ground is required for in-depth storage, and a large road network is required within the area

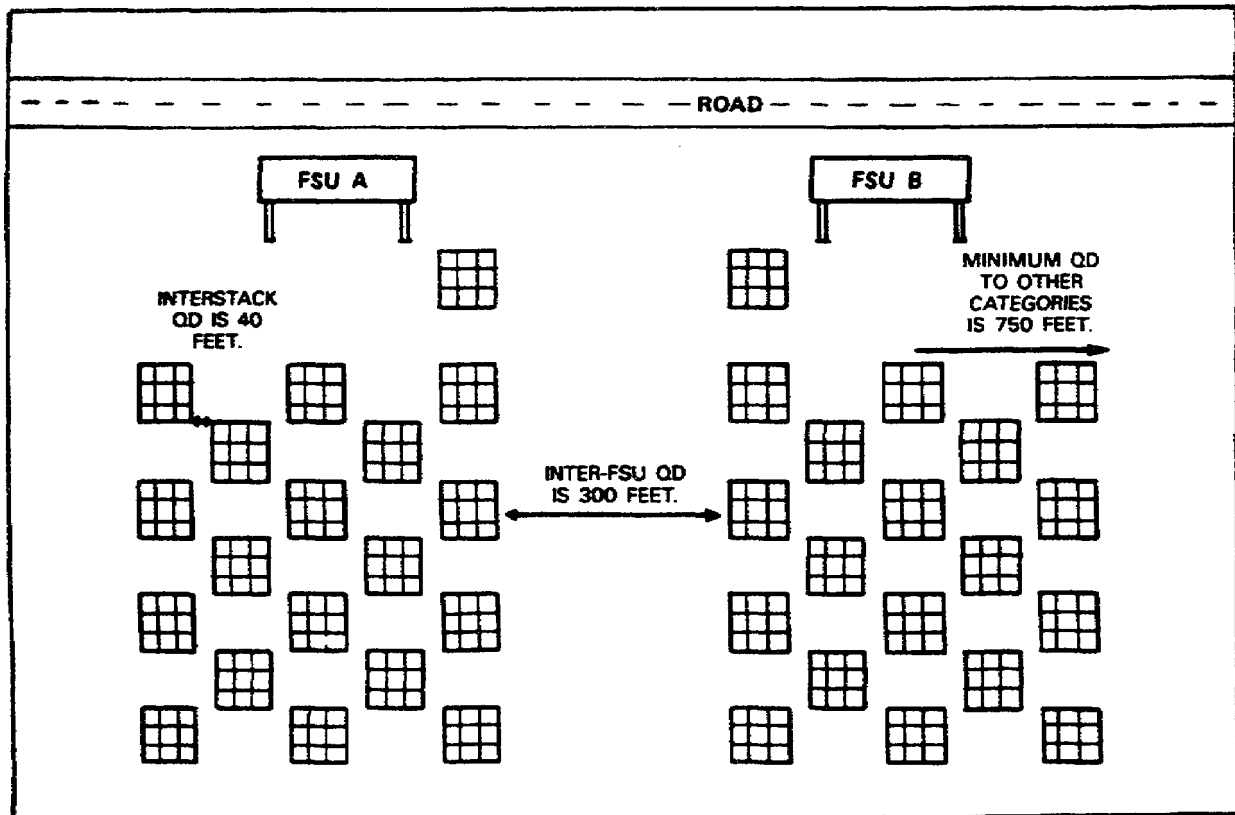


Figure 1-8. An Area Storage Plan.

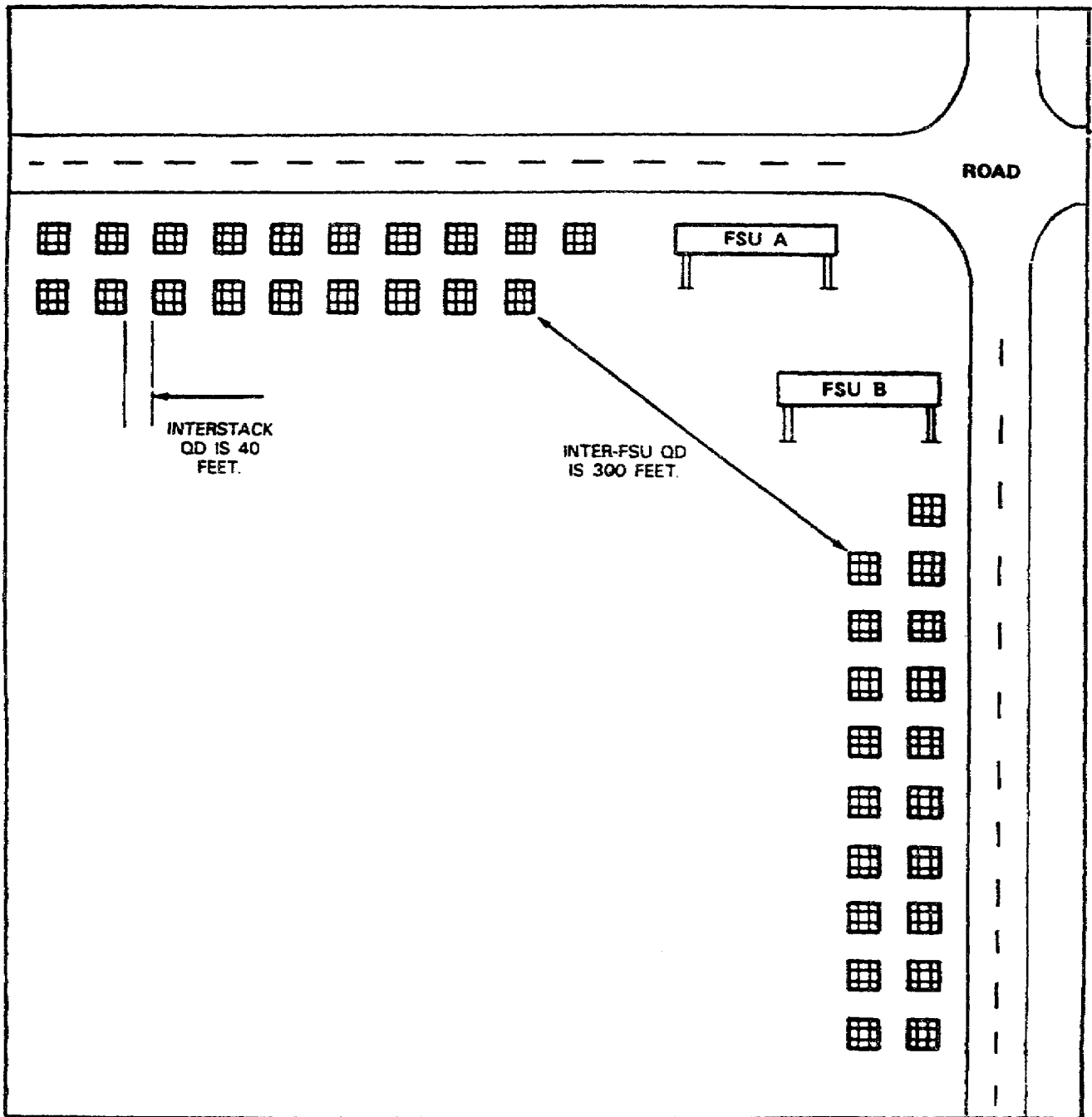


Figure 1-9. A Roadside Storage Plan.

**Area and Roadside Combination Storage**

Area and roadside combination storage uses both area and roadside storage (Figure 1-10). The most common storage system in use, it combines the advantages of both area storage and roadside storage.

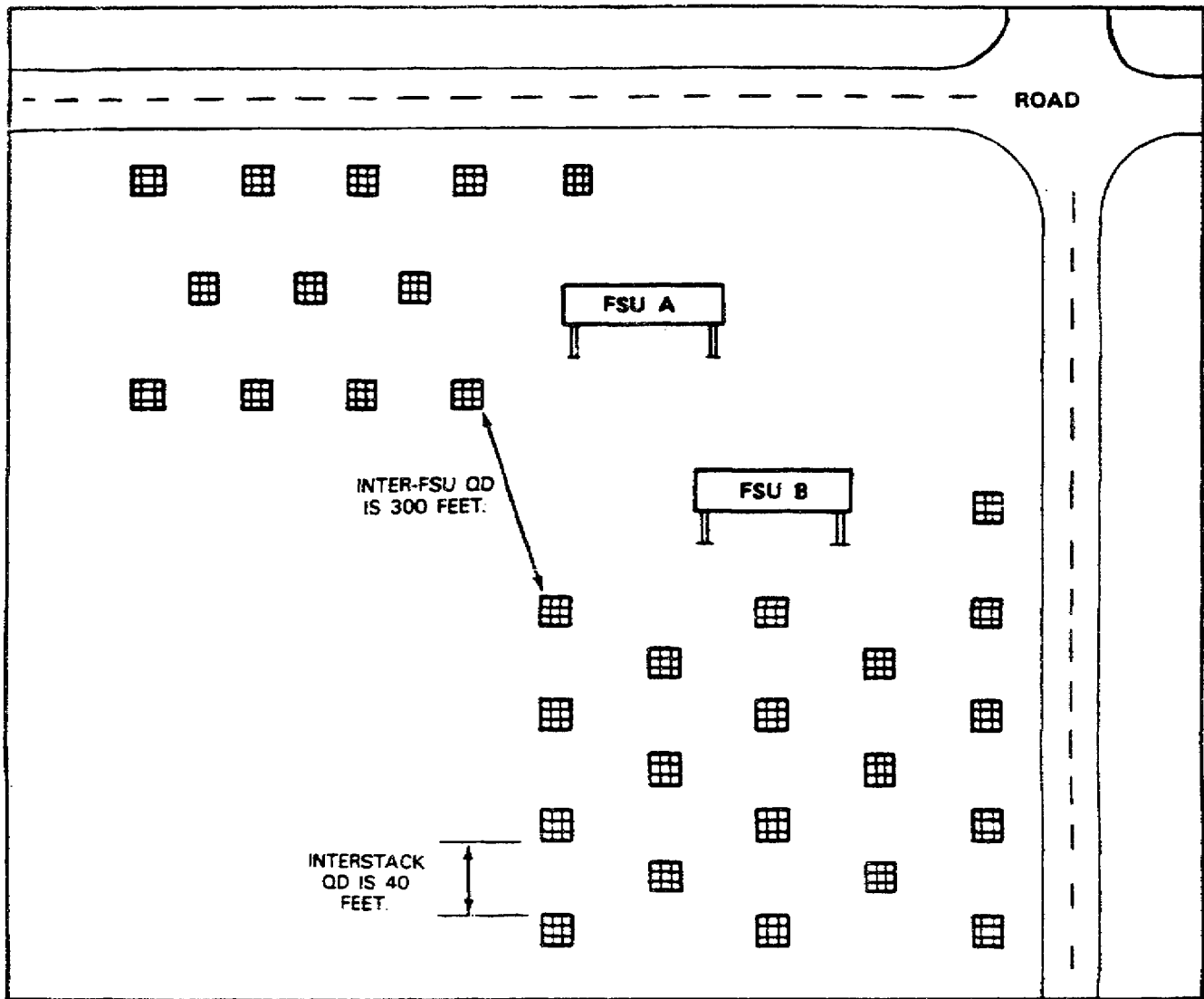


Figure 1-10. An Area and Roadside Combination Storage Plan.

### Modular Storage System

A modular storage system is a series of connected pads or cells separated only by barricades or berms (mounds or walls made of dirt) (Figure 1-11). A module can have no more than eight pads or cells. Modular storage should be used only as an alternate system, because it violates the QD requirements in most cases. There may be more than one module in an ASP. Modules may be arranged to form module blocks.

The advantages of modular storage are that less land is required, less security is required because of the smaller areas, and the road network and transportation requirements are reduced within the ASP. There are three disadvantages: (1) A fire or explosion in one pad or cell could start fires in the cells. These fires could be caused by flying fragments or burning debris thrown out by the explosion. (2) They provide a good target for indirect enemy fire — such as mortar attacks — and to air attack, because everything is stored close together. (3) The modules must be built, and this requires bulldozers and other equipment.

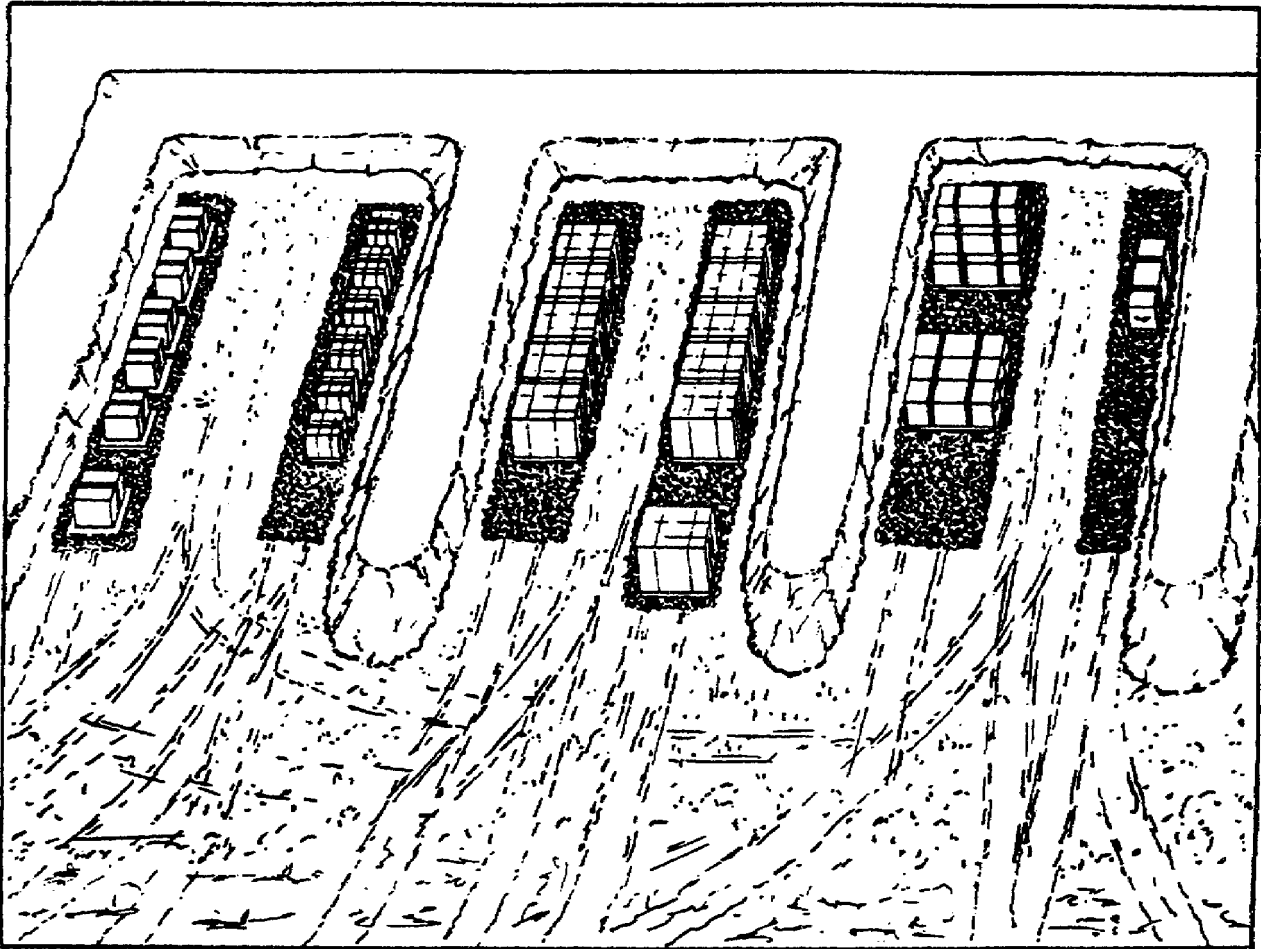


Figure 1-11. A Modular Storage System.

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## FIELD STORAGE CATEGORIES

Ammunition storage in the field is often restricted by the amount of land available and the need to make issue operations easier by storing components of complete rounds in adjacent stacks. This requirement must be balanced against the hazards of a chain explosion, fragment range, spread of fires, and contamination. The desires of supply personnel to render faster service and the safety requirements of the ammunition experts led to the development of field storage categories (FSCs). The use of FSCs for ammunition storage is based on the following four factors:

1. Ammunition items with similar storage risks are stored together.
2. The maximum quantities of ammunition that may be stored at one location or between locations are based on gross weight, including packaging.
3. Normally, only one type of ammunition is stored in each stack.
4. Small arms ammunition, except bulk-packed incendiary and tracer cartridges, may be stored with any category of ammunition.

## MM2601, Lesson 1

The FSCs are listed below. These seven storage categories are for conventional ammunition. Special ammunition, i.e., improved conventional munitions (ICM), is stored separately and is divided into general categories not discussed here.

<i>Category</i>	<i>Item</i>
A	Fixed and semifixed artillery ammunition (except incendiary and chemical).
B	Propelling charges, fuzes, primers, flash reducers, and separate loading artillery projectiles (except incendiary and chemical).
C	Mortar ammunition and grenades (except incendiary and chemical).
D	Chemical ammunition of all types, including incendiary and bulk-packed small arm tracer cartridges.
E	All demolition explosives, mines (except VX loaded), and demolition components.
F	Rockets, rocket motors, and rifle grenades (except chemical).
G	Air Force ammunition items consisting of unfuzed high explosive (HE) bombs, aircraft torpedoes, fragmentation bombs and clusters, and the fuzes and primer detonators for these items.

Within an ASP, the ammunition storage location is referred to by three different terms: sections, field storage units (FSUs), and stacks. An ASP ideally is broken down into three separate sections. FSUs are subdivisions of the sections. At least two stacks are required to make up an FSU. Each ammunition storage location is given an alphanumeric (letters and numbers) code, such as 1A1, 2B6, or 3D2. If one type of ammunition is stored in Section 1, FSU Alpha, Stack 1, its storage location code is 1A1. If another type of ammunition is stored in Section 3, FSU Delta, Stack 2, its storage location code is 3D2.

The layout in Figure 1-12 shows an example of how sections, FSUs, and stacks may be placed in an ASP. The storage location code for each area is also given. Examine Figure 1-12. Locate the three sections and identify all the stacks that are part of it. Remember, all of the stacks in a section begin with the number of that section. Look at Section 1. Locate storage locations 1A1, 1A2, and 1A3. These three storage locations represent one FSU. They are all Section 1, FSU A (1A), but three different stacks (1A1, 1A2, and 1A3). Remember, it takes at least two stacks to make an FSU. In the layout shown in Figure 1-12, every storage location is a stack. How many FSUs are there in Section 3? If you look closely, you will see FSUs A, B, C, D, and E—a total of five FSUs.

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### QUANTITY-DISTANCE REQUIREMENTS FOR FIELD STORAGE CATEGORIES

There are three things to remember before getting into quantity-distance (separation distance) requirements for FSCs. Interstack distance is the minimum allowable distance between the closest edges of adjacent stacks. Inter-FSU distance is the minimum allowable distance between the closest edges of the nearest stacks in adjacent FSUs. Intercategory distance is the minimum allowable distance from an FSU of one category to the nearest FSU of another category. Figure 1-13 illustrates the interstack, inter-FSU, and intercategory distances. Refer to Figures 1-8, 1-9, and 1-10 for other examples of these distances.

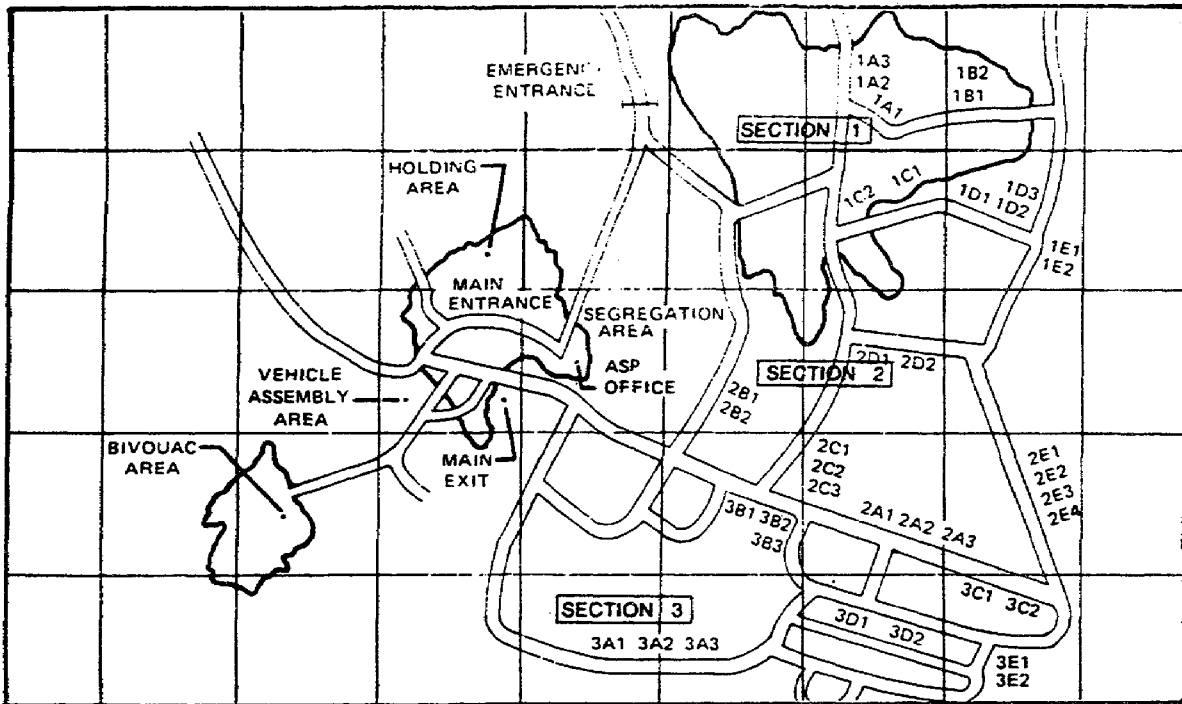


Figure 1-12. ASP Layout with Storage Locations and Codes.

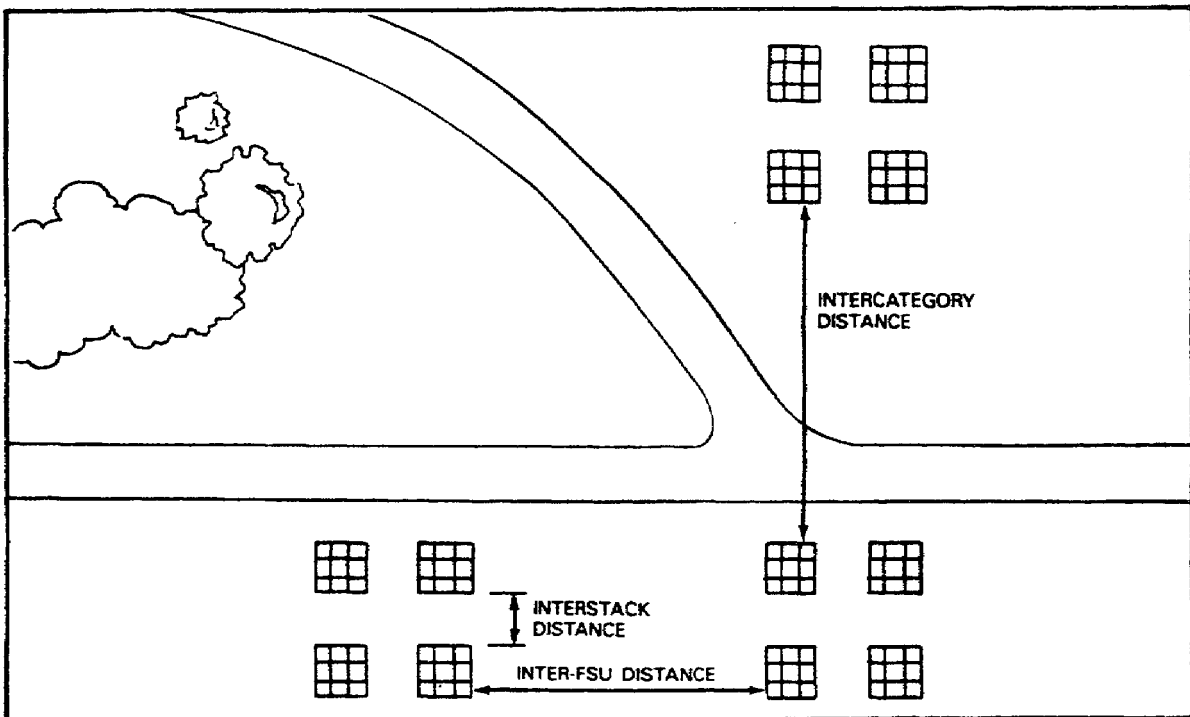


Figure 1-13. Field Storage Distances.



## MM2601, Lesson 1

The table in Figure 1-14 is an extract from TM 9-1300-206, *Ammunition and Explosive Standards*. It gives the minimum allowable distances to meet quantity-distance requirements when storing ammunition in the field. If, for example, you are storing 105mm high explosive semifixed artillery cartridges and want to know the maximum gross tons per stack; gross tons per FSU; and the minimum allowable distance between stacks barricaded, stacks unbarricaded, FSU unbarricaded, and categories; first find out the category for semifixed ammunition (see page 12). Since it is high explosive and not incendiary or chemical, it is Category A. The Category A section of the table in Figure 1-14 indicates that if a stack is under 10 tons, the top line is used; for 10 tons up to 20 tons, the second line is used. Assume you are storing 20-ton stacks. Use the table in Figure 1-14 and you will get the following answers:

- The maximum gross tons per stack is 20 tons.
- The maximum gross tons per FSU is 400 tons.
- The minimum allowable distance between unbarricaded stacks is 50 feet.
- The minimum allowable distance between barricaded stacks is 40 feet.
- The minimum allowable distance between unbarricaded FSUs is 300 feet.
- The minimum allowable distance between categories is 750 feet.

If you know the categories for the storage of conventional ammunition, using the table is easy. Use the table to follow these problems to their solution:

1. What is the minimum distance, in feet, between unbarricaded stacks containing less than 10 tons if the ammunition is 81mm mortars, high explosive? Mortar ammunition, high-explosive loaded, is Category C, so the answer is 75 feet.
2. What is the minimum distance in feet required between Category B and Category D ammunition? Categories A, B, and D use the same table for field storage. The answer is 750 feet.
3. How many feet are required between Categories E and A? Category A, only requires 750 feet, but Category E requires 900 feet. Always use the maximum distance required. In this case, the answer is 900 feet.
4. If you have a 10-ton stack of propelling charges and a 10-ton stack of fuzes, what is the minimum separation distance required between two unbarricaded stacks? Both of these are in Category B. Unbarricaded stacks require at least 50 feet between stacks. But, Note 2 says that there must be at least 100 feet between propelling charges and any other stacks, whether barricaded or unbarricaded. The answer is 100 feet.

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## PROTECTING AMMUNITION FROM THE ELEMENTS

There are three rules to follow in providing the proper storage conditions for ammunition: provide adequate shelter, provide adequate dunnage, and provide adequate ventilation.

### Shelter

In a field setting, there are several ways to provide ammunition stocks with adequate shelter. See Figure 1-15.

Category A, B or D					
Gross tons per stack	Gross tons per FSU	Minimum distance in feet between			
		Stacks unbarricaded	Stacks barricaded	FSU unbarricaded	Categories
Less than 10 . . . . .	400	40	30	300	750
10-20 maximum . . . . .	400	50	40	300	750

NOTE: 1. If desirable, fixed and semifixed smoke ammunition, except WP., may be stored in category A.  
 NOTE: 2. The minimum distance between a stack of propelling charges and any other stack must be 100 feet whether barricaded or unbarricaded.

Category C					
Gross tons per stack	Gross tons per FSU	Minimum distance in feet between			
		Stacks unbarricaded	Stacks barricaded	FSU unbarricaded	Categories
Less than 10 . . . . .	300	75	60	300	900
10-30 maximum . . . . .	300	105	75	300	900

NOTE: Whenever storage space is limited, category C ammunition may be combined with category E.

Category E					
Gross tons per stack	Gross tons per FSU	Minimum distance in feet between			
		Stacks unbarricaded	Stacks barricaded	FSU unbarricaded	Categories
Less than 5 . . . . .	50	75	60	300	900
5-10 maximum . . . . .	50	105	75	300	900

Category F					
Gross tons per stack	Stacks barricaded and unbarricaded	Gross tons per FSU	Minimum distance in feet between		
			FSU unbarricaded	FSU barricaded	Categories
The maximum allowance gross weight per stack will be 20 tons.	See note below-	20	200	75	1500
		30	230	90	1500
		40	265	99	1500
		50	295	101	1500
		60	330	120	1500
		80	390	135	1500
		100	455	150	1500

NOTE: The minimum distance between barricaded stacks will be 75 feet. The minimum distance between unbarricaded stacks will be 150 feet.

Category G Class V			
Gross tons per FSU	Minimum distance in feet between		
	FSU unbarricaded	FSU barricaded	Categories
20	200	75	1500
30	230	90	1500
40	265	99	1500
50	299	101	1500
60	330	120	1500
80	390	135	1500
100	455	150	1500

NOTE: Under normal conditions, the Department of the Air Force will store and issue all class V supplies; however, depot commanders should always be prepared to handle these supplies in emergencies.

Figure 1-14. Extract from TM 9-1300-206, Quantity-Distance Requirements for Field Storage Categories.

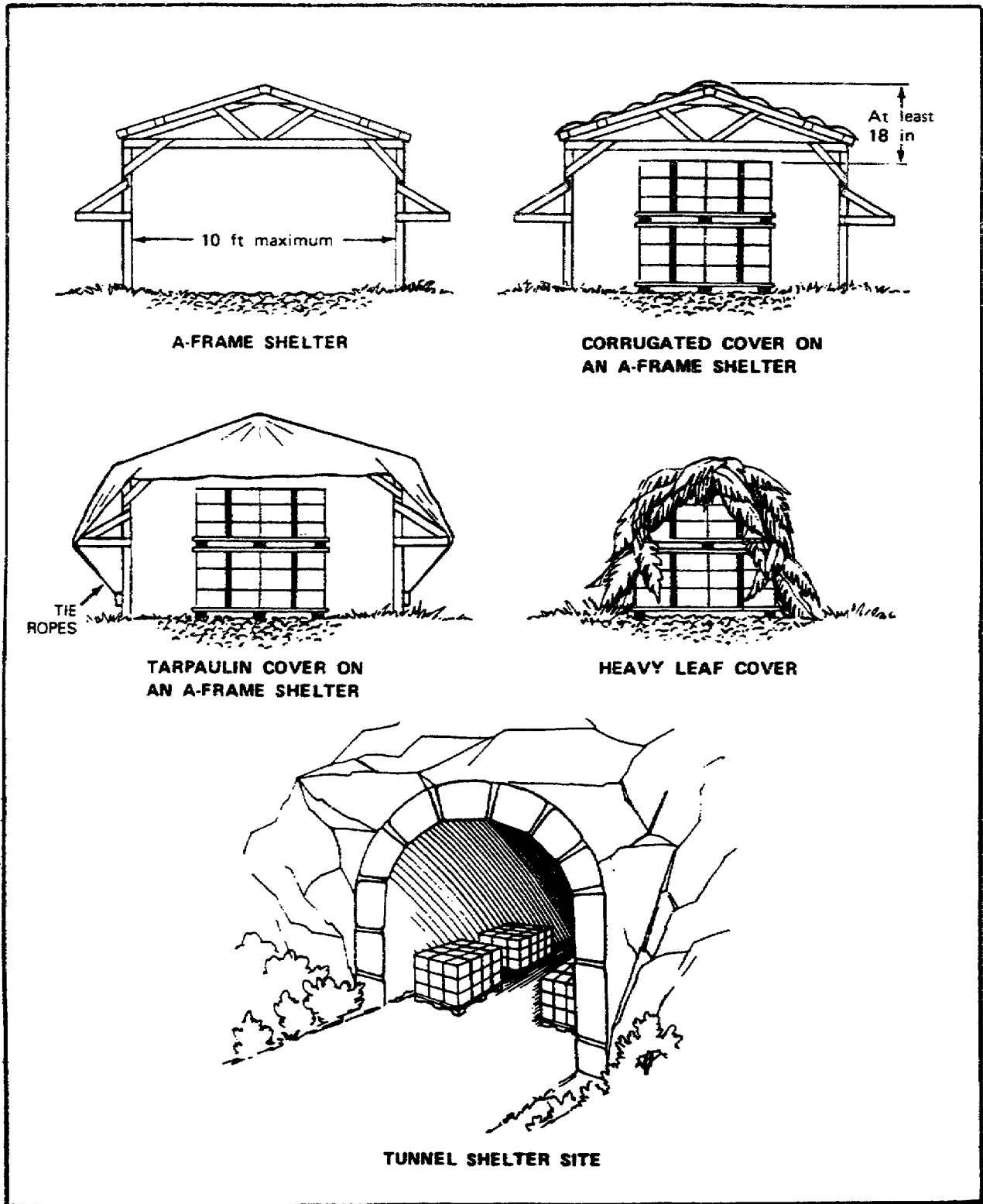


Figure 1-15. Protecting Ammunition from the Elements.

- Build temporary shelters if the situation permits. (This would depend on the length of time the ASP is expected to be in the same location.) The A-frame shelter provides good protection. The top of the arch must be high enough to allow 18 inches of airspace above the stacks of ammunition. Crushed rock makes a good pad or floor for an A-frame but a level surface with good drainage and dunnage will do.
- Build an A-frame shelter covered with corrugated metal.
- Build an A-frame shelter covered with tarpaulins.
- Cover the ammunition with limbs that have heavy leaf cover. If you are in a tropical climate, palm fronds provide excellent cover, concealment, and protection from rain and sun.
- Store the ammunition in quarries or tunnels, provided they have a good drainage system or an adequate pump to keep them dry.

### Dunnage

Dunnage is any material used to keep ammunition off the ground. In addition, dunnage allows rain or running water to pass under the munitions. Palletized ammunition has its own dunnage supplied by the pallet the ammunition is on. Loose boxes of ammunition or loose projectiles must have some type of dunnage to protect the ammunition. There must be at least three inches of dunnage for outdoor storage of ammunition. See Figure 1-16.

Some good dunnage materials include: four-by-four-inch lumber (best), empty metal containers, empty ammunition boxes, empty propelling-charge cans, empty fiber containers, felled trees, and bricks or stones.

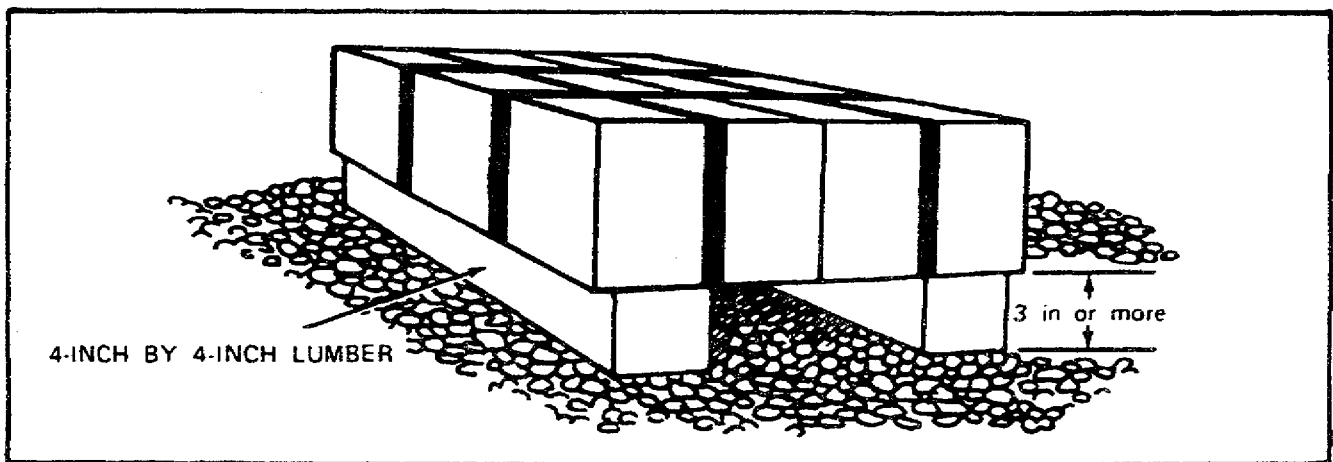


Figure 1-16. Dunnage for the Outdoor Storage of Ammunition.

### Ventilation

Dunnage provides ventilation under an ammunition stack. If you cover a stack or pallet of ammunition with a tarpaulin, always use lumber or a small A-frame to allow for ventilation above the stack. Stacked pallets provide their own ventilation. If you are storing boxed ammunition, and using block stack storage (covered later in this lesson), place strips of one-by-two-inch wood every fourth layer for additional ventilation. Use common sense in this situation. For example, if the boxed ammunition will be stored only for a short period of time—three days or less—the strips are not necessary.

**Outdoor Storage Priorities**

There are priorities for storing ammunition outdoors. Knowing these priorities will help you to determine which ammunition should be put in temporary shelters or covered with foliage. The priorities for storing ammunition in covered storage areas appear below.

<i>Items</i>	<i>Priority</i>
Fuzes, primers, and boosters .....	1
Pyrotechnics .....	2
Propelling charges .....	3
Demolition priming devices .....	4
Munitions with black powder expelling charges .....	5
Chemical ammunition .....	6
Rocket ammunition .....	7
Small arms ammunition .....	8
Grenades .....	9
Mines .....	10
Demolition items .....	11
Fixed and semifixed ammunition .....	12
Separate loading projectiles .....	13
Bombs .....	14

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**STACKING UNPALLETIZED AMMUNITION**

Although ammunition procedures assume the use of unitized (palletized) loads of ammunition, there are still many times it may be necessary to deal with loose boxes or rounds of ammunition. Some ammunition is received unpalletized. The load may have broken apart in shipment, or it may be the result of enemy actions. Pallets are broken in handling or unbanded for partial issues. Banding may be broken and pallets deteriorated when received. In some places, MHE is not available in forward ASPs.

If it is necessary to stack unpalletized ammunition, four methods can be used: block stack, pyramid stack, step-down stack, and slope or Arctic stack.

The block stack (Figure 1-17) is the most common. It gives good stability and is the easiest to build. It also makes the counting of containers during inventorying easier. The block stack should be used whenever conditions do not dictate the use of another method of stacking.

The pyramid stack (Figure 1-18) is used in the desert to eliminate shadows. It has a low silhouette and is easy to camouflage. The pyramid stack is formed by making tiers with the boxes. For example, if you have 55 ammunition boxes to store, lay a base of 25 containers, then 16 containers on top of the first tier, then 9 containers, then 4, and finally 1 container centered on top to produce the desired pyramid. This formula may be adapted to other quantities of boxes. The figure shows 30 boxes in a pyramid stack.

The step-down stack (Figure 1-19) is similar to the pyramid stack, except that it is used for longer containers. It is formed by overlapping the containers. It reduces shadows and is easy to camouflage.

The slope or Arctic stack (Figure 1-20) is used to prevent containers from freezing together, to permit water to drain, and to provide good ventilation.

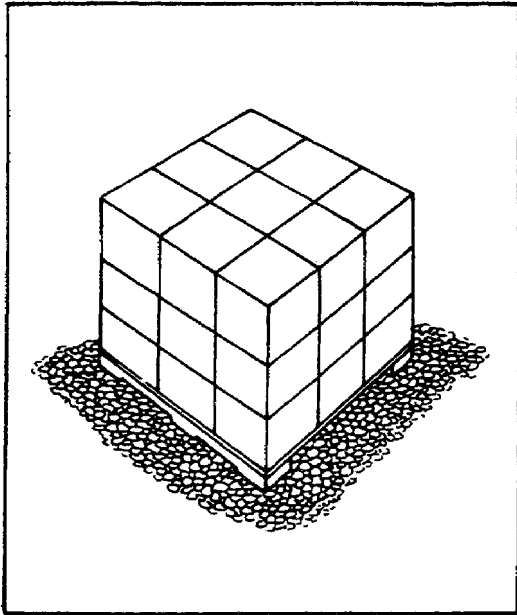


Figure 1-17. Ammunition in a Block Stack.

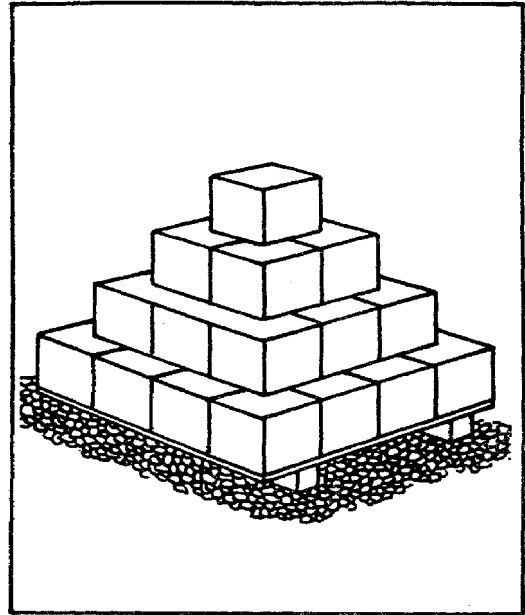


Figure 1-18. Ammunition in a Pyramid Stack.

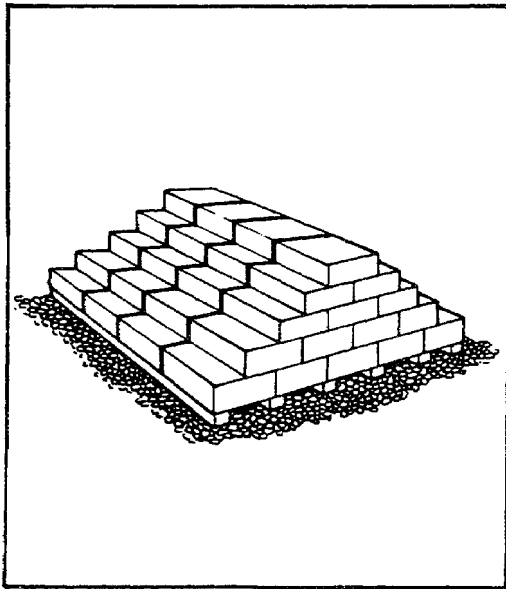


Figure 1-19. Ammunition in a Step-down Stack.

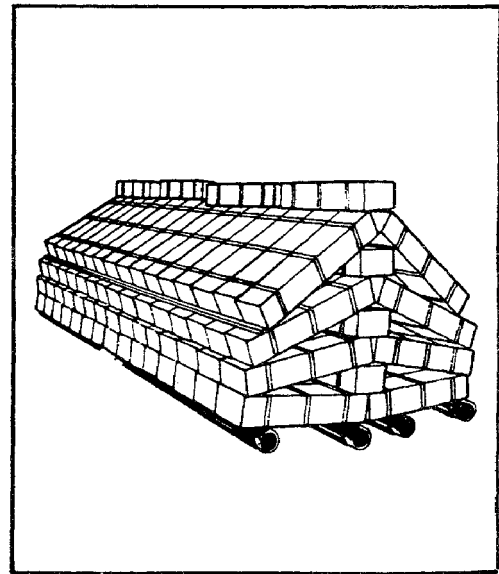


Figure 1-20. Ammunition in a Slope or Arctic Stack.

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**REVIEW EXERCISES**

Circle the letter of the correct answer to each question.

1. What is the maximum distance an ammunition supply point (ASP) should be located from the supporting corps storage area (CSA) ?
  - a. 10 kilometers.
  - b. 20 kilometers.
  - c. 100 kilometers.
  - d. 120 kilometers.
  
2. Who controls ammunition transfer points (ATPs) ?
  - a. The ASP officer.
  - b. The senior ammunition specialist.
  - c. The corps commander.
  - d. The division ammunition officer.
  
3. What is the anticipated percentage of ammunition stocks that ammunition transfer points will receive from the corps storage area?
  - a. 100 percent.
  - b. 90 percent.
  - c. 80 percent.
  - d. 70 percent.
  
4. A storage location has a designation of 3A6. With what section is this stack stored?
  - a. Section 3.
  - b. Section 6.
  - c. Section A.
  - d. Section 3A.
  
5. What are the three rules to follow in providing proper storage conditions for ammunition?
  - a. Provide adequate land, shelter, and security.
  - b. Provide adequate shelter, dunnage, and ventilation.
  - c. Provide adequate dunnage, dryness, and security.
  - d. Provide adequate personnel, dunnage, and shelter.

6. How far must a helicopter sling-out area be located from the bivouac area?
  - a. At least 100 meters.
  - b. At least 250 meters.
  - c. At least 550 meters.
  - d. At least 750 meters.
  
7. In which field storage category (FSC) is chemical ammunition stored?
  - a. FSC D.
  - b. FSC E.
  - c. FSC F.
  - d. FSC G.
  
8. In which field storage category are high explosive separate loading artillery projectiles stored?
  - a. FSC A.
  - b. FSC B.
  - c. FSC C.
  - d. FSC D.
  
9. Which of the following items would have top priority for covered storage?
  - a. Rocket ammunition.
  - b. Mines.
  - c. Grenades.
  - d. Chemical ammunition.
  
10. In which geographic location would the pyramid stack be used?
  - a. The desert.
  - b. The Arctic.
  - c. The tropics.
  - d. The mountains.

Recheck your answers to the Review Exercises. When you are satisfied that you have answered every question to the best of your ability, check your answers against the Exercise Solutions. If you missed two or more questions, you should retake the entire lesson, paying particular attention to the areas in which your answers were incorrect.



**Lesson 2**  
**AMMUNITION STORAGE IN**  
**THE ZONE OF INTERIOR**

---

TASKS	This lesson is based on the following tasks from soldier's manual STP 9-55B12-SM: 093-400-1153, Place Ammunition in Outdoor Storage, and 093-400-1157, Place Ammunition in Magazine Storage Site.
OBJECTIVES	When you have completed this lesson, you should be able to describe ammunition magazine storage facilities in the zone of interior, describe outdoor ammunition storage facilities in the zone of interior, and identify the correct ammunition storage procedure.
CONDITIONS	You will have this subcourse book and will work without supervision.
STANDARD	You must score at least 70 on the end-of-subcourse examination, which covers this lesson and lessons 1, 3, 4, and 5.

---

**TYPES OF STORAGE FACILITIES**

Ammunition storage operations in the zone of interior (ZI) are governed by different standards and, generally, different publications than ammunition storage in the theater of operations. For example, the requirements in TM 9-1300-206, *Ammunition and Explosives Standards*, do not apply to subcommands, installations, and activities under the direct control of the US Army Armament, Munitions, and Chemical Command (AMCCOM). Ammunition storage depots in the ZI under their command use AMCCOM Regulation 385-100, *Safety Manual*, as their ammunition storage guide.

The two types of ammunition storage facilities used in the ZI are magazine storage and outdoor storage.

**Magazine Storage Facilities**

Magazine storage facilities in the ZI include earth-covered magazines and aboveground magazines.

**Earth-covered Magazines.** Earth-covered magazines provide the best and safest type of ammunition storage. They allow better temperature control than other types of storage facilities, and are particularly desirable for the storage of propellants and pyrotechnics. They should be used for storing separate loading projectiles and high explosives if enough space is available. Earth-covered magazines include, but are not limited to the standard igloo, the steel arch, and the Stradley (Figure 2-1).

The standard igloo magazine is an older, obsolete design that is not practical for storing large missiles and rockets in this age of palletization and containerization. The door is too small to admit a standard pallet by forklift.

The steel-arch magazine has the same curved metal inside walls and ceiling as the standard igloo magazine (Figure 2-2). It has a concrete floor and a door wide enough to handle pallets and missile containers.

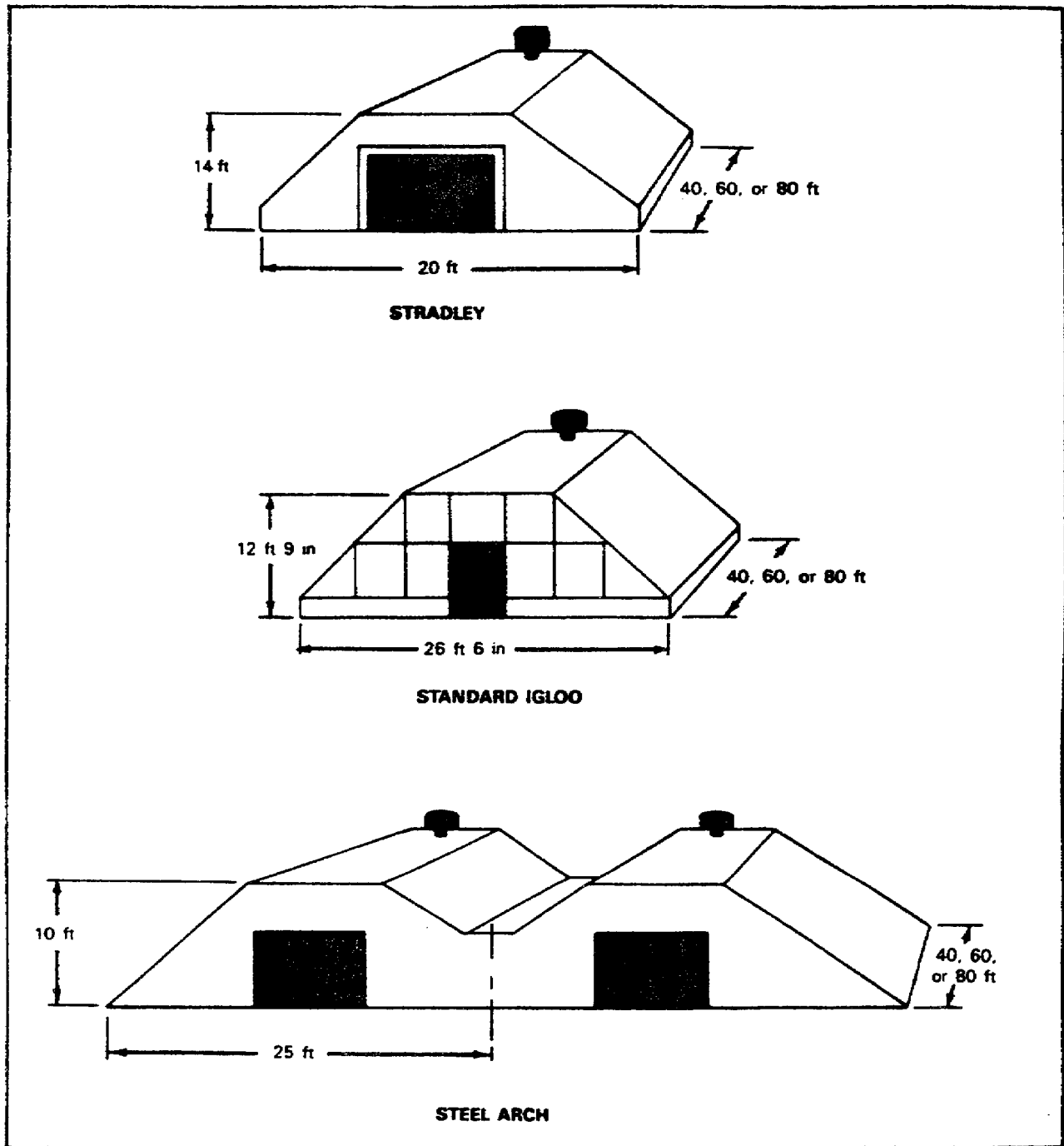


Figure 2-1. Earth-covered Magazines with Some Common Specifications.

The Stradley magazine is built of reinforced concrete and has a wide door or double doors. Forklifts can go in and out easily with pallets and missile containers. Because of its straight-side design, nearly 25 percent more ammunition can be stored in it than in the standard igloo or the steel-arch magazines of comparable size (see Figure 2-2).

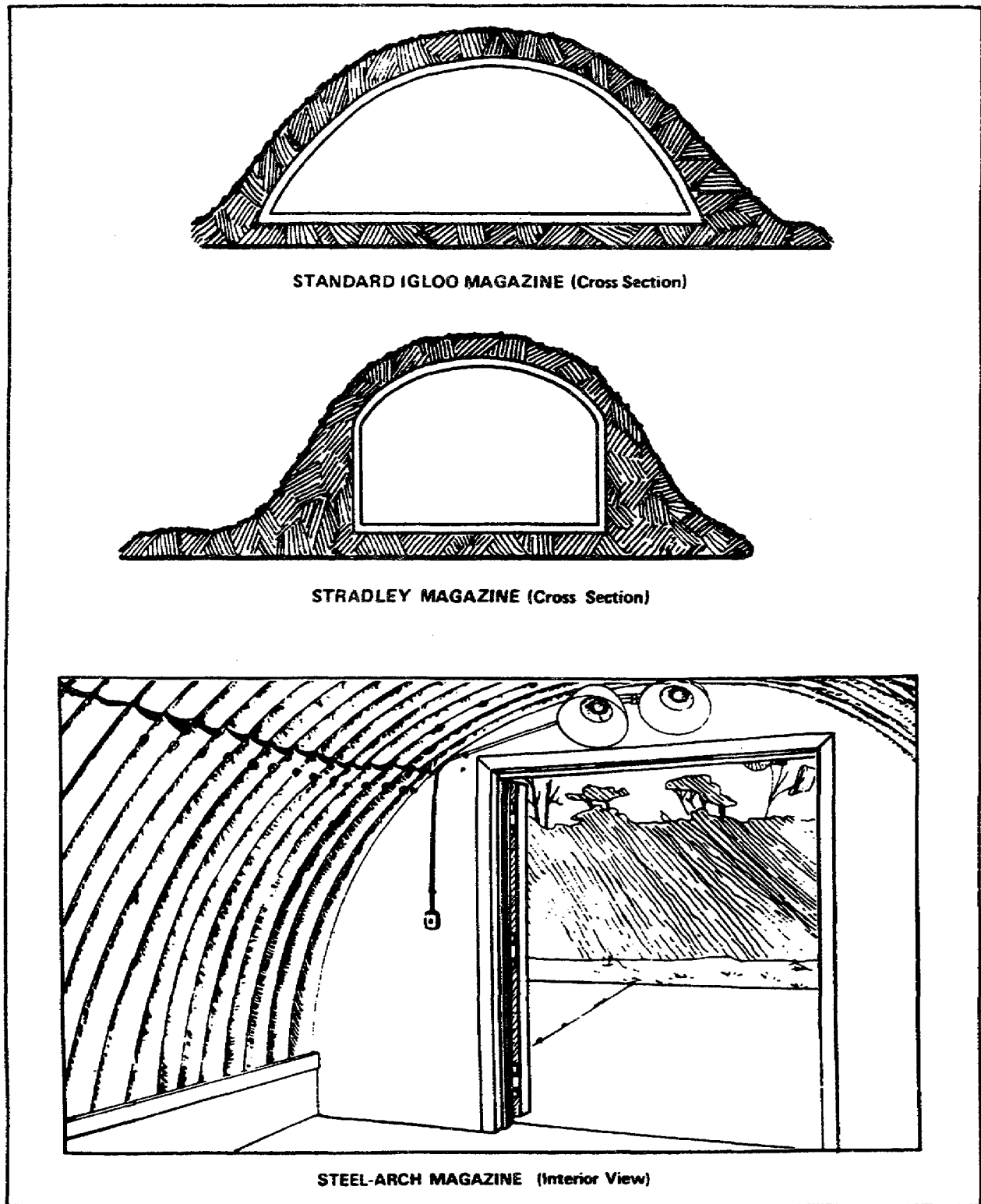


Figure 2-2. Comparison of the Standard Igloo, Stradley, and Steel-arch Magazines.

**Above-ground Magazines.** Standard above-ground magazines (Figure 2-3) are made with steel and concrete frames and have hollow tile walls filled with sand. Their concrete floors are sometimes covered with a sparkproof surface. Designed to store 155mm and 8-inch separate loading projectiles, they usually have small arms ammunition, firing devices, and other less explosive or less hazardous items stored in them. The largest above-ground magazines are about 51 feet wide by 218 feet long.

There are two main types of above-ground magazines – high explosive or black powder magazines and primer or fuze magazines.

High explosive or black powder magazines (Figure 2-4) are used to store bulk explosives, such as TNT and black powder.

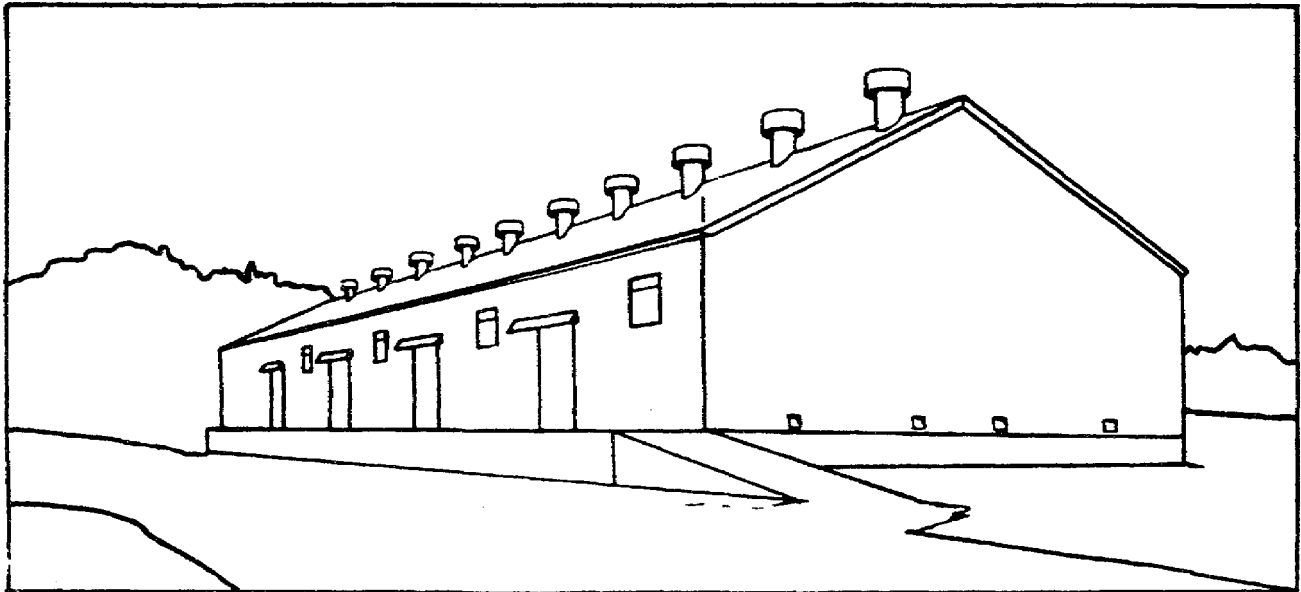


Figure 2-3. Standard Above-ground Magazine.

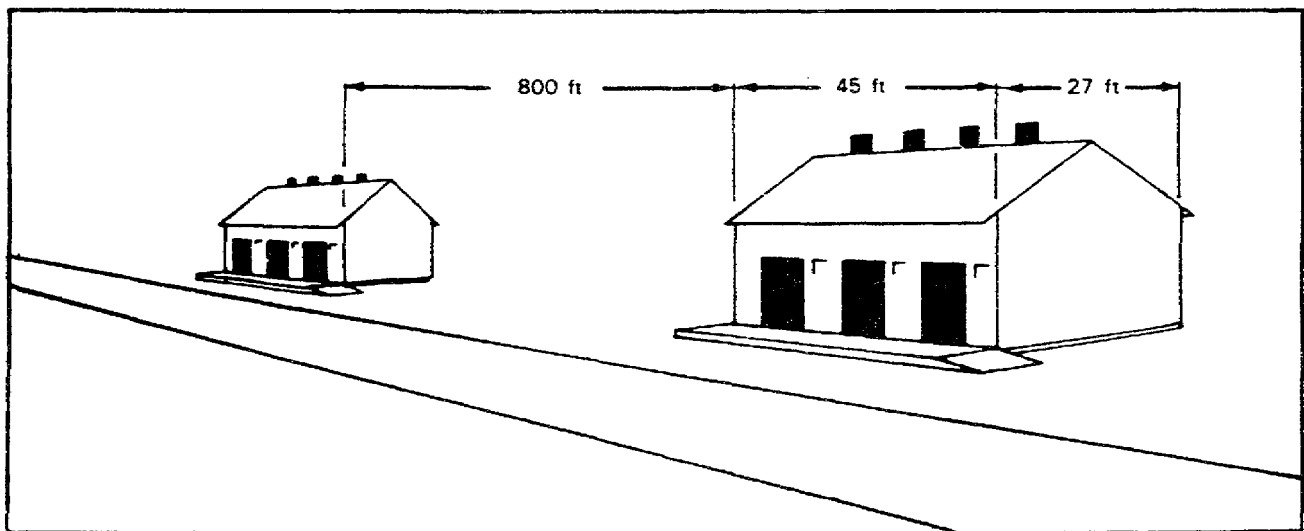


Figure 2-4. High Explosive or Black Powder Magazines.

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Primer or fuze magazines (Figure 2-5) are built exactly the same as high explosive magazines. What makes them different is the spacing between each magazine, 300-400 feet versus 800 feet. Less space is required for primer or fuze magazines because primers and fuzes contain much less explosives than the bulk explosives stored in high explosive or black powder magazines.

Magazines and barricaded open sites in the magazine area may be used for the storage of ammunition-related inert items, such as fuze wrenches, eyebolt-lifting plugs, grommets for artillery projectiles, and dummy and training ammunition.

Bulk solid propellants, bagged propellants, pyrotechnics, bulk high explosives, and items critical for security reasons must not be stored outdoors. Critical items include fragmentation type hand grenades, Claymore antipersonnel mines, and antitank weapons, such as the shoulder-fired light antitank weapon (LAW).

### Outdoor Storage Facilities

Outdoor storage is usually available in ZI depots for the temporary storage of munitions until they can be stored in magazines. There are three main types of temporary outdoor storage facilities: X-sites, Y-sites, and sites between earth-covered magazines.

X-sites (Figure 2-6) are unbarricaded and have some type of temporary cover. (Unbarricaded means they have no mounds of dirt, berms, or barricades around the sides of the sites.) Y-sites, on the other hand, have barricades and, normally, are without covers (Figure 2-7). Y-sites are classified as either improved or unimproved open space, depending on their floor (see Figure 2-7).

Storage sites between earth-covered magazines (Figure 2-8) are usually authorized in depots, provided certain requirements are met, when the earth-covered magazines are spaced at least 400 feet apart. The sites must be barricaded and they must be separated from the barricaded sides of the nearest magazine by at least 185 feet.

No outdoor storage site may be located within 1,200 feet of above-ground magazines. In some cases where a storage area is not available, motor vehicles, tank artillery pieces, and the like, may be stored in the open in an ammunition storage magazine area. The equipment must be parked at least 800 feet from magazines or open storage sites containing ammunition.

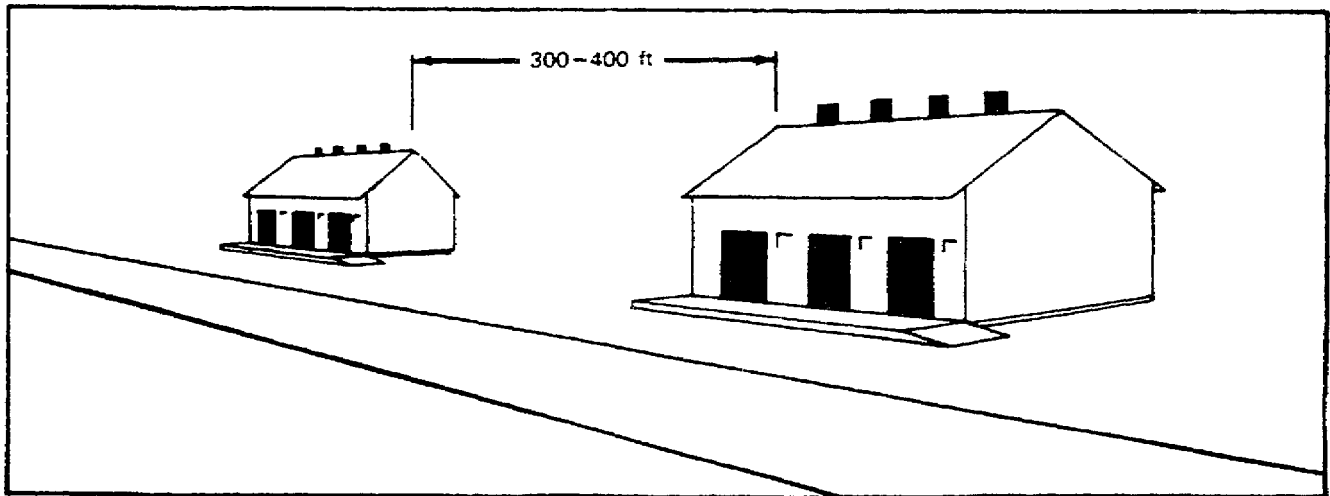


Figure 2-5. Primer or Fuze Magazines.

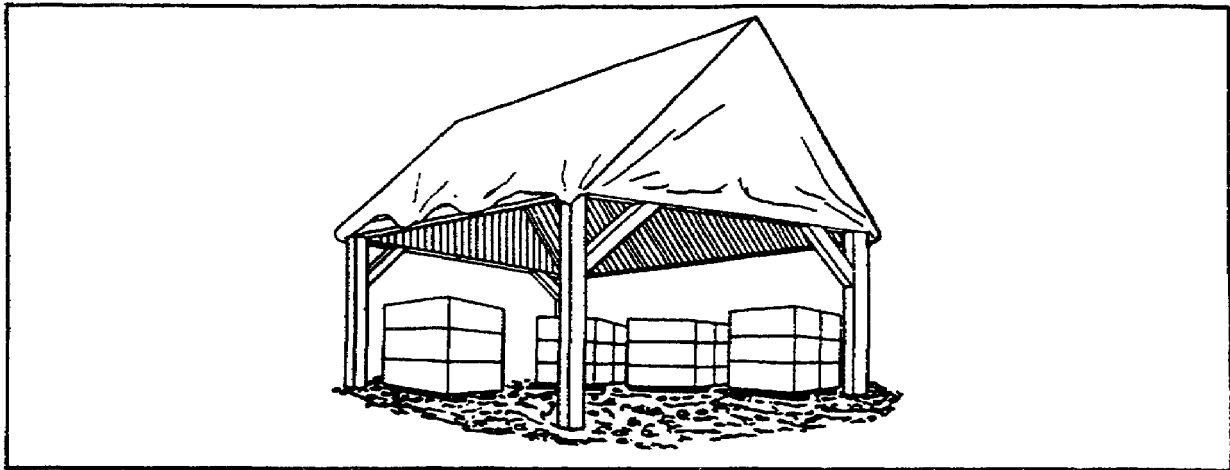


Figure 2-6. X-site Outdoor Storage.

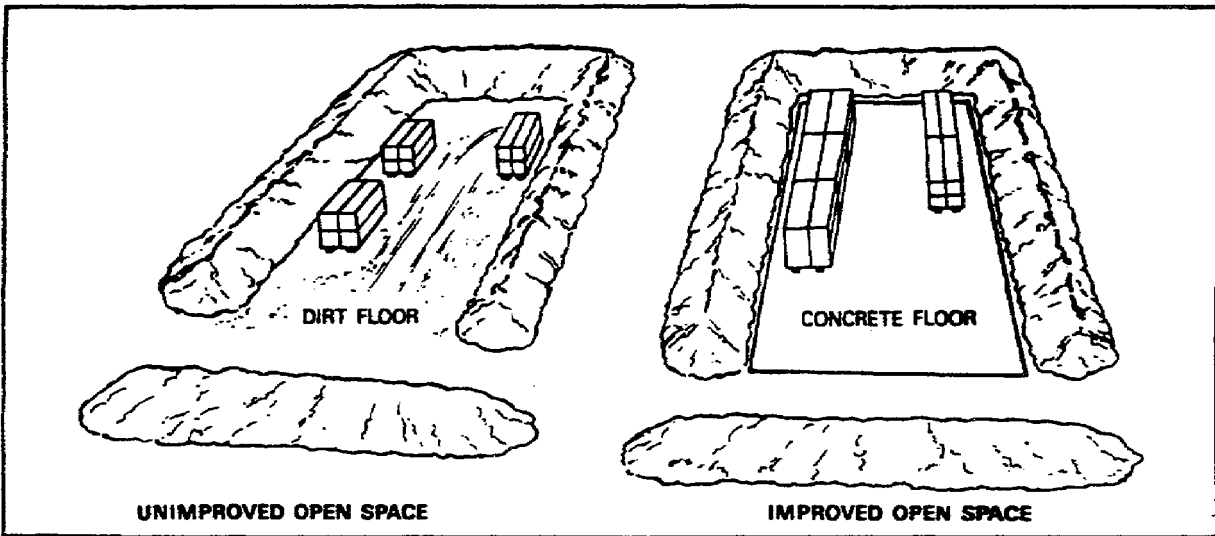


Figure 2-7. Unimproved and Improved Open Space Y-sites.

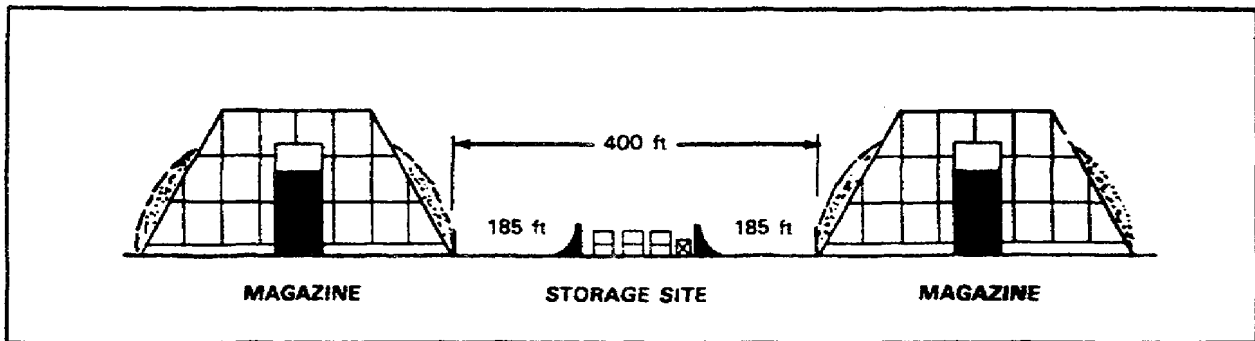


Figure 2-8. Storage Site Between Earth-covered Magazines.

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**MAGAZINE STORAGE PROCEDURES**

- All magazines must have a DA Label 85 (Magazine Placard) (Figure 2-9) posted near the door of the magazine or on the door.
- Vegetation around ammunition storage sites must be controlled. Usually a 50-foot firebreak is required.
- Components or loose rounds (those not boxed or palletized) are not stored in the same magazine as properly packaged items.
- Conveyors, pallet jacks, equipment, tools, empty boxes, etc., are not stored in the same magazine as ammunition or explosives.
- Ventilators are kept open and the correct fusible links are installed. (Fusible links will melt in a fire and close the ventilators.) Doors and locks on magazines must be kept in good working condition.
- The door or doors of a magazine must be kept open when a crew is working inside. The number of crews must not exceed the number of doors. Magazines must be kept locked at all times when no one is working in them.
- Ammunition must be placed or stacked in a magazine according to the applicable storage drawings.
- Ammunition lot numbers and markings must be placed so that they can be read without moving boxes or climbing on stacks.
- At least two inches of dunnage are required for magazine storage.
- Ammunition is always stacked from the back to the front, large lots first.
- When more than one lot is stored, all items of a lot are stored together and a clear line of separation between lots is indicated.

---

**OUTDOOR STORAGE PROCEDURES**

- The site must be level and well-drained.
- The site must be free from readily ignitable materials.
- Ammunition must be stored on steel dunnage where practical.
- Ammunition must be stored on not less than three inches of dunnage.
- Ammunition must be covered with nonflammable or fire-resistant overhead covers where munitions require cover.
- Ammunition must be stored so that at least 18 inches of airspace is between the top stack and the cover.
- Ammunition must be inspected often to find unstable stacks or piles of trash between or under stacks.
- Excess dunnage may not be stored between magazines or between outdoor sites and magazines. Dunnage should be stored at a site selected for that time. Dunnage may be stored for a time near a stack or site being worked, if it is stacked no closer than 50 feet to the stack or site.
- Outdoor sites should have suitable fire-fighting equipment and fire symbols should be posted at the site.

# STORAGE AND CARE OF EXPLOSIVES

(MAGAZINE PLACARD)

## GENERAL INSTRUCTIONS

1. Always handle explosives and ammunition carefully.
2. Remove dirt, grit, and foreign materials from containers and ammunition before placing in storage.
3. Do not store explosives and ammunition in damaged containers.
4. Keep all containers in magazine effectively closed so that the contents cannot be handled, examined, or removed.
5. Store each lot separately. Make the piles stable. Provide for a free circulation of air to all parts of the pile. Raise containers and ammunition off the floor by dunnage.
6. Do not open, repair, pack or repack containers in or within 100 feet of magazine, except as permitted by TM 9-1300-206.
7. Do not keep empty containers, tools, or other materials in magazine.
8. Absolute cleanliness and order must be maintained.
9. Use only approved electric lights, lanterns or flashlights in magazines.
10. Do not smoke, or bring matches into magazine.
11. Do not allow unauthorized persons in or near magazine.
12. Keep magazine spark tight, with ventilators well screened, and no openings around doors or foundations.
13. Keep doors locked when magazine is unattended. Close doors when vehicle is approaching platform unless vehicle is equipped with spark arrestor on exhaust.
14. Keep the 50 foot cleared space around above ground magazines free from combustible material.
15. Two or more doors, when available, must be open when personnel is working in a magazine containing explosives or ammunition.
16. Post conspicuously one or more copies of these rules in magazine.
17. See TM 9-1300-206 for detailed instructions.

DA 85

ORD 0870

Figure 2-9. DA Label 85 (Magazine Placard).



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**REVIEW EXERCISES**

Circle the letter of the correct answer to each question.

1. What is the preferred type of storage site for ammunition?
  - a. Outdoor storage sites.
  - b. Above-ground magazines.
  - c. Earth-covered magazines.
  - d. X- or Y-sites.
  
2. Which type magazines are spaced 800 feet apart?
  - a. Above-ground magazines.
  - b. Stradley magazines.
  - c. Primer or fuze magazines.
  - d. High explosive or black powder magazines.
  
3. Which label is posted near or on the door of each magazine?
  - a. DA Label 50.
  - b. DA Label 85.
  - c. DA Label 100.
  - d. DA Label 120.
  
4. Which of the following storage sites are unbarricaded and have temporary cover?
  - a. X-sites.
  - b. Y-sites.
  - c. Sites between earth-covered magazines.
  - d. Above-ground magazines.
  
5. How many inches of dunnage are required for the outdoor storage of ammunition?
  - a. At least two inches.
  - b. At least three inches.
  - c. At least four inches.
  - d. At least five inches.

Recheck your answers to the Review Exercises. When you are satisfied that you have answered every question to the best of your ability, check your answers against the Exercise Solutions. If you missed one or more questions, you should retake the entire lesson, paying particular attention to the areas in which your answers were incorrect.

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**Lesson 3**  
**REWAREHOUSING AMMUNITION**

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TASK	This lesson is based on the following task from soldier's manual STP 9-55B12-SM: 093-400-2131, Rewarehouse Ammunition.
OBJECTIVE	When you have completed this lesson, you should be able to state which procedures will be most effective when rewarehousing ammunition.
CONDITIONS	You will have this subcourse book and will work without supervision.
STANDARD	You must score at least 70 on the end-of-subcourse examination, which covers this lesson and lessons 1, 2, 4, and 5.

---

**NEED FOR REWAREHOUSING**

Rewarehousing is the art of using available space, personnel, and equipment to ensure efficient storage and receipt of ammunition with a minimum of handling. This involves moving munitions from one site to another or rearranging ammunition pallets, boxes, or containers within the same storage site. Rewarehousing also includes completing the paperwork (forms) when rewarehousing has been completed.

Since receipts and issues of munitions seldom match, planning storage space is difficult. Generally speaking, rewarehousing takes place when merging lots of the same type of items would make more space available at the pad, magazine, or other storage site. Advance notice of an incoming shipment of ammunition to an ASP could also trigger a rewarehousing effort to make room for the incoming ammunition. Rewarehousing is a continuous process, and it is the key to good ammunition management.

---

**REWAREHOUSING PROCEDURES**

Rewarehousing begins with instructions from the supervisor. Say that your supervisor tells you to go to storage pad 1A1 and move the 155mm projectiles on that site to storage pad 2B3. The supervisor will then give you a partially completed DA Form 3151-R (Ammunition Stores Slip) or a DA Form 4508 (Ammunition Transfer Record). The DA Form 3151-R (Figure 3-1) will be used as an illustration. The use of DA Form 4508 will be explained later in the lesson.

Since you are dealing with palletized projectiles, you will need a crane or a wrecker to handle the pallets. Your first choice would be a crane (as authorized in the table of organization and equipment for an ammunition company). If a crane is not available, a wrecker (Figure 3-2) or a rough-terrain forklift could be used to complete the job. You must get permission from your supervisor to use a wrecker or a rough-terrain forklift. Arrange for MHE at each site. A different type of MHE may have to be used at each site.

The next piece of equipment needed is a set of slings (see Figure 3-2). The authorized slings are contained in the ammunition, direct support, general support, tool set (NSN 4940-00-322-6058). Arrange for a set of slings at each site. Safety equipment, such as gloves, safety shoes, and ear protection, should be issued to each crew member.

AMMUNITION STORES SLIP <small>FOR USE OF THIS FORM, SEE FM 9-38. THE PROFORM IS UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND.</small>		AUTHORITY 6066-0001		DATE 6067			
FROM: Stack Control		NAME OF ACTIVITY ASP#1 Vilseck, Ger					
TO: 1 <sup>st</sup> Platoon		VEHICLE NO.					
RECEIPT <input type="checkbox"/>	ISSUE <input type="checkbox"/>	OTHER (SPECIFY) Rewarehouse <input checked="" type="checkbox"/>		DRIVER			
NSN DODIC NOMENCLATURE	LOT NO.	ACC	LOCATION		PLTS -BXS	TOTAL ROUNDS	INIT
			FROM	TO			
1320-00-529-7331-D544 Proj, 155MM HE, M107	10P5-31	A	1A1	283	80	640	
REMARKS Rewarehouse from pad 1A1 to 283. Records show 640 rounds on 1A1							
DATE	SIGNATURE OF ISSUING CHECKER	DATE	SIGNATURE OF RECEIVING CHECKER				

DA FORM 3151-R APRIL 1978 REPLACES DA FORM 3151, 1 JUL 68 WHICH MAY BE USED UNTIL EXHAUSTED

Figure 3-1. Partially Completed DA Form 3151-R (Ammunition Stores Slip).

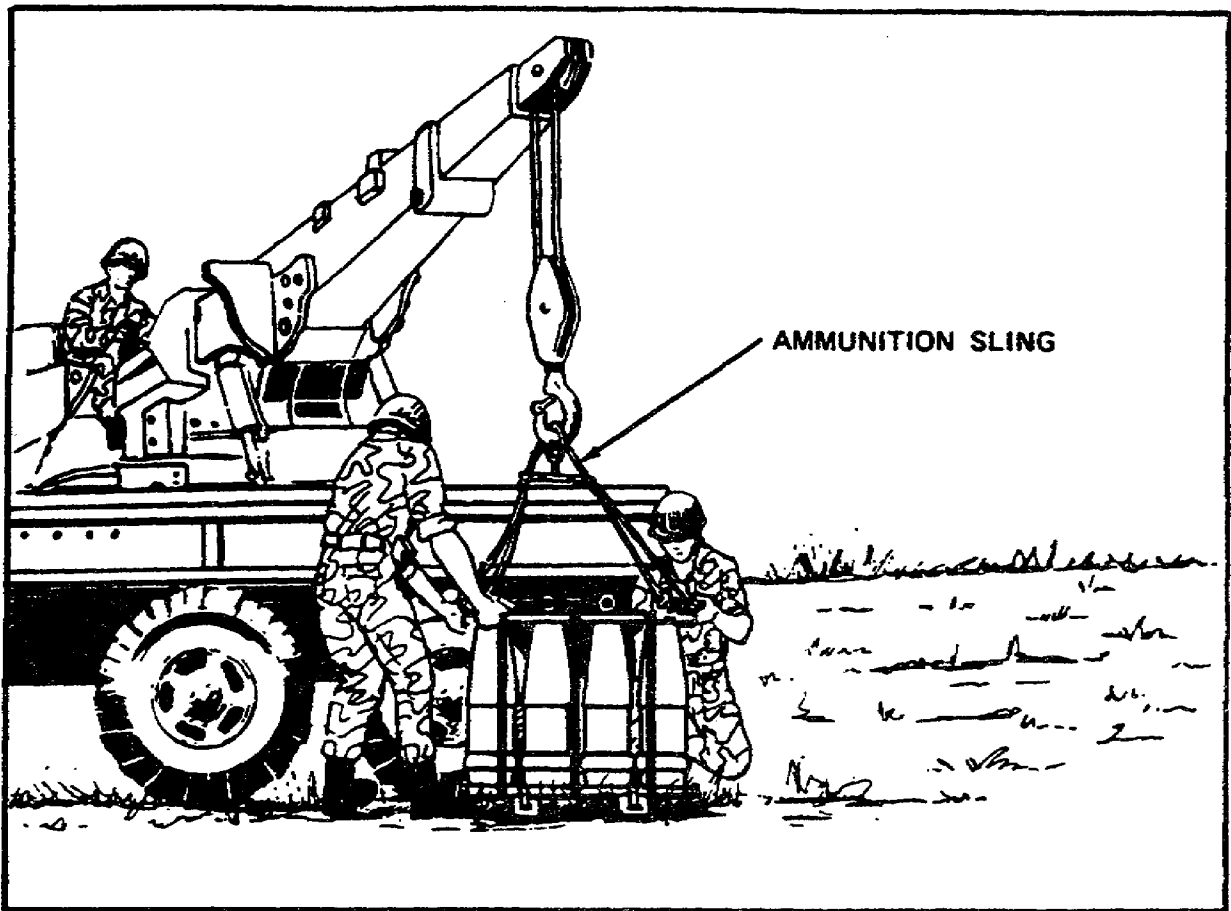


Figure 3-2. Rewarehousing Pallets by Wrecker.

The next thing you will need is a means of moving the pallets from storage pad 1A1 to 2B3. Unless the storage sites are side-by-side or across the road from each other, you will need some form of transportation. Since the ammunition to be moved would require more than one trip if only one truck were used, at least two trucks will be needed for an efficient operation.

Accountability is important when rewarehousing ammunition. The DA Form 3151-R showed that 640 rounds were stored at site 1A1. Make sure that the number of rounds rewarehoused matches that figure. If it does not, the stock accounting or inventory records were incorrect. You must account for every round loaded and off-loaded from site to site. Your job is to check and double-check the amount being moved.

Suppose you find that you transferred only 77 full pallets of lot IOP-5-31\* rather than 80 as are listed on the original form. What should be done to correct this discrepancy? After making certain that only 77 pallets of that lot were picked up from pad 1A1 and moved to pad 2B3, enter the correction on the DA Form 3151-R. The correct amount of rounds is figured like this:

$$\begin{array}{r}
 77 \text{ pallets} \\
 \times 8 \text{ rounds per pallet} \\
 \hline
 616 \text{ total rounds}
 \end{array}$$

\*Although the lot numbers used in this subcourse are being replaced by a new lot numbering system as outlined in Military Standard 1168-A, the old lot numbers will be used in the field for many years to come.

MM2601, Lesson 3

To make a correction, draw a line through the number 640 and enter the number 616 on the DA Form 3151-R. Then draw a line through the number 80 under "PLTS" and enter the number 77. Then initial in the last column. See Figure 3-3.

When rewarehousing within the same site or pad you do not need a DA Form 3151-R. Say that your supervisor tells you to rewarehouse pad 2C2 (Figure 3-4). Study the pad closely and determine what you would do.

The solution (Figure 3-5): Move the small lots to the front. Separate lots PA-10-3 and IOP-1-1 enough to tell they are different and for an inventory team to easily check them. Leave space to store several incoming pallets. The small lots are now in the front and are readily available to be issued first.

A rule of good ammunition management is to issue your small lots first. When rewarehousing, always move the small lots to the front. Leave enough space between lots so that the nomenclature and lot numbers can be checked easily.

Rewarehousing palletized boxed ammunition is easy compared with rewarehousing projectiles and loose boxes. This situation used on pad 2C2 is a common example. DODIC C445 is boxed 105mm cartridges. They come palletized, so all of the handling is done by rough-terrain forklift.

AMMUNITION STORES SLIP				AUTHORITY		DATE:		
<small>FOR USE OF THIS FORM, SEE FM 9-38. THE PROPONENT IS UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND.</small>				6066-0001		6067		
FROM: Stock Control				NAME OF ACTIVITY ASP # 1 Yilseck, Ger				
TO: 1st Platoon				VEHICLE NO.				
RECEIPT <input type="checkbox"/>		ISSUE <input type="checkbox"/>		OTHER (SPECIFY) Rewarehouse <input checked="" type="checkbox"/>		DRIVER		
NSN	DODIC NOMECLATURE	LOT NO.	ACC	LOCATION		PLTS	TOTAL ROUNDS	INIT
				FROM	TO			
1320-00-529-7331-0544	Proj, 155MM HE, M107	IOP-5-31	A	1A1	2B3	77 <del>80</del>	616 <del>640</del>	BB
REMARKS Rewarehouse from pad 1A1 to 2B3. Records show 640 rounds on 1A1								
DATE	SIGNATURE OF ISSUING CHECKER			DATE	SIGNATURE OF RECEIVING CHECKER			
6067	SP4 Bill Baker			6067	SP4 Bill Baker			
<small>DA FORM 3151-R APRIL 1978 REPLACES DA FORM 3151, 1 JUL 68 WHICH MAY BE USED UNTIL EXHAUSTED</small>								

Figure 3-3. DA Form 3151-R with Discrepancy Corrected.

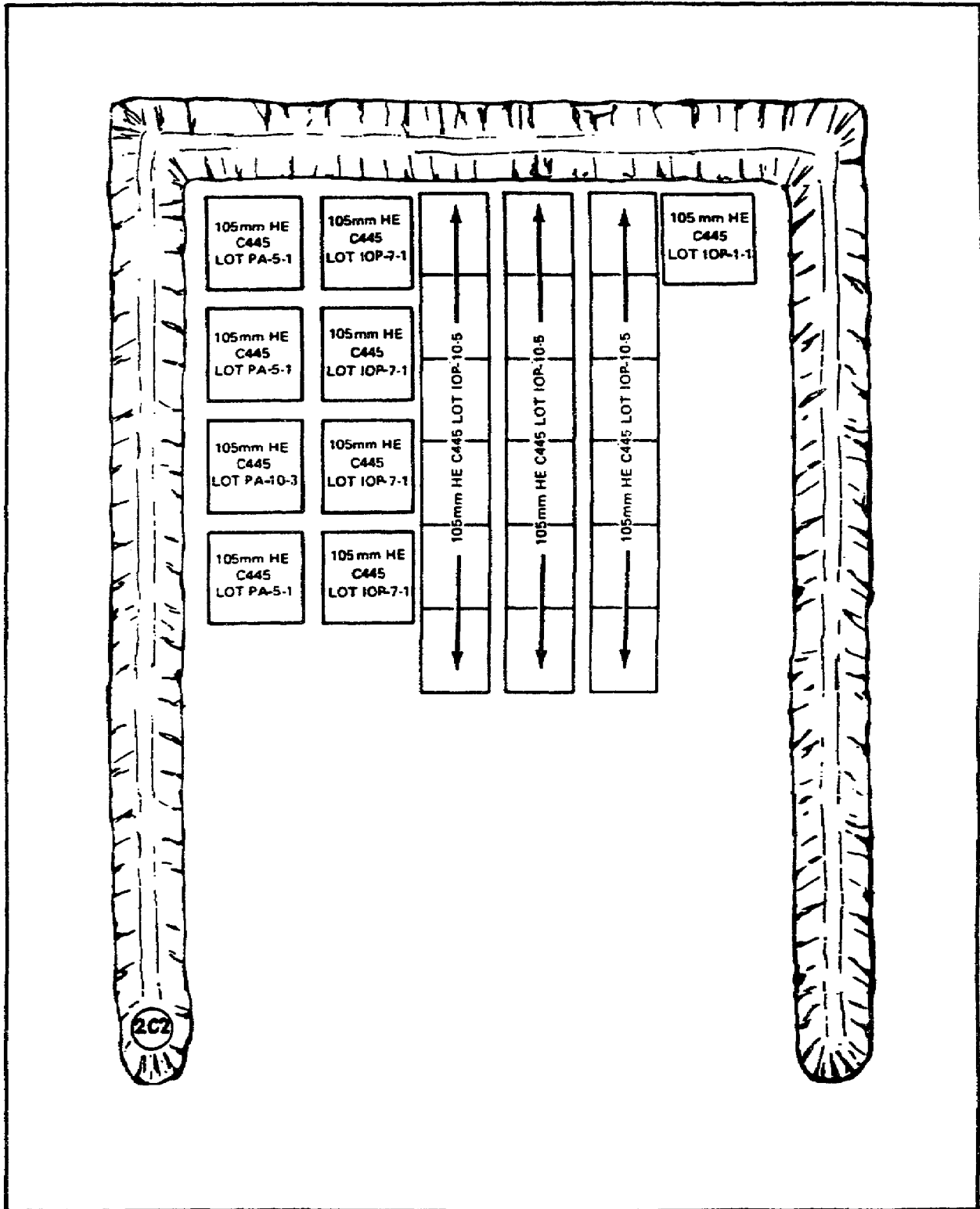


Figure 3-4. Rewarehousing Situation.

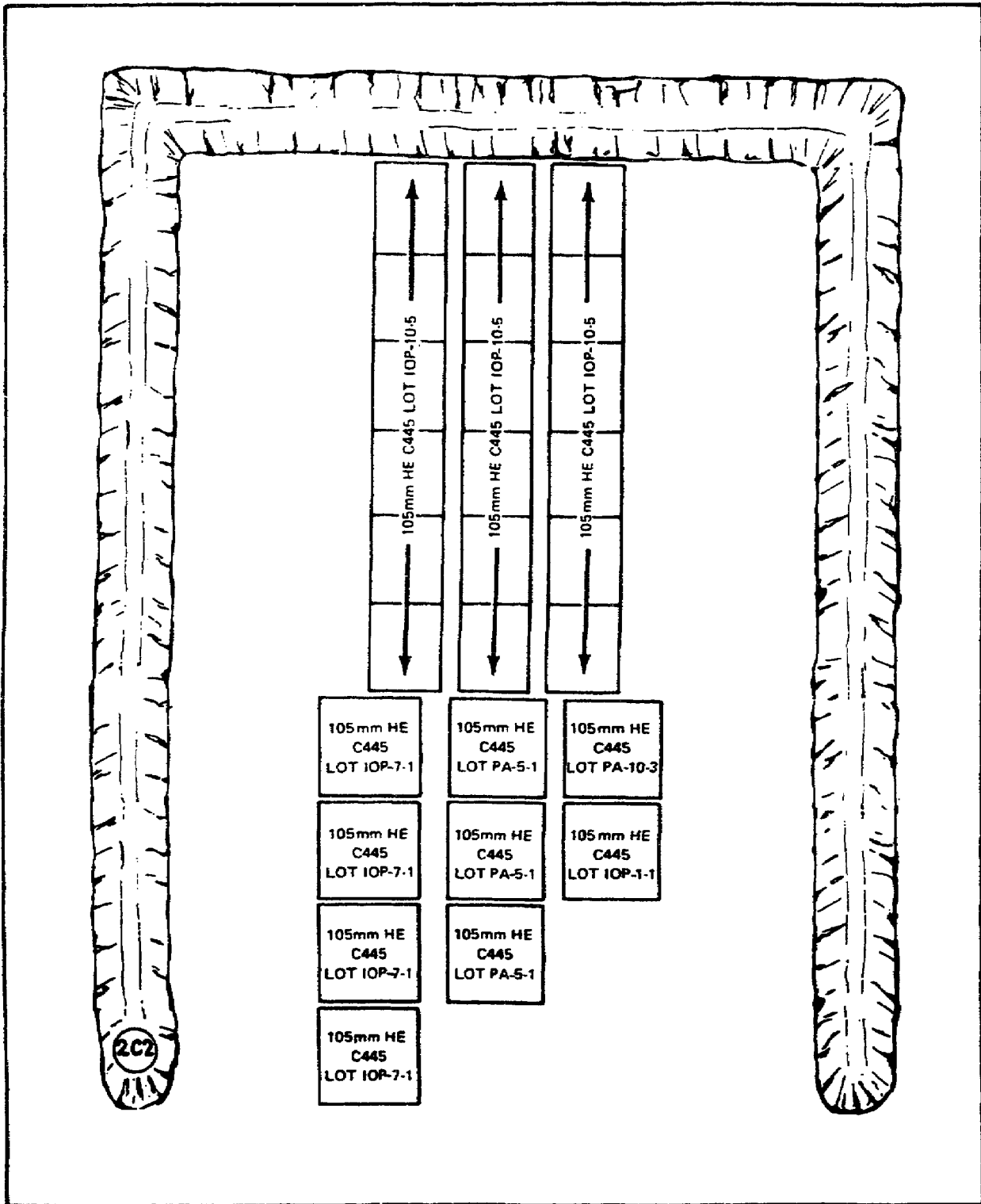


Figure 3-5. Rewarehousing Solution.

Here is another example of rewarehousing. Figure 3-6 shows three pads. Develop a plan to rewarehouse these pads to make room for an incoming shipment of 4.2-inch HE cartridges, DODIC C704. There are 48 rounds per pallet, 2 rounds per box, for a total of 3,360 rounds incoming. The 3,360 rounds consist of two lots-LS-1-2 and LS-1-3. There are 2,880 rounds in lot LS-1-3.

The solution (Figure 3-7): There are 60 pallets of lot LS-1-3 that would require almost a whole pad. Therefore, remove all pallets from 1D5. Merge lot LS-5-2 on 1D6 and move the remaining lots to 1D4. There are 10 pallets of lot LS-1-2 incoming; this lot could be placed on 1D6. You may have developed your plan differently; however, if you had enough room for the incoming ammunition, with minimum handling, and put the small lots at the front, then your plan may also be correct.

Another situation you may face when rewarehousing is a storage site or pad with many loose boxes lying on pallets or dunnage. A good example would be a site with artillery fuzes. It is doubtful that only pallets of fuzes would be issued to using units. A site or pad containing fuzes would almost certainly have many loose boxes. It is amazing how easily loose boxes can be scattered and mixed in a short time. How would you handle the task of rewarehousing a fuze pad?

First, separate the loose containers by DODIC; for example, N335 PD Fuzes, N319 PD Fuzes, and N411 VT Fuzes. Then, using empty pallets or dunnage, place all items of one DODIC on the pallets or dunnage by lot number. You may have five or six lots on one pallet. Just be sure to leave enough space between them so the checker issuing the items can easily see the nomenclatures and lot numbers. Then continue separating the items by DODIC and lots until all the same DODICs are in one general area and all of the same lots are located together. All three pads, 1D4, 1D5, and 1D6, now contain 4.2-inch high explosive cartridges, DODIC C704.

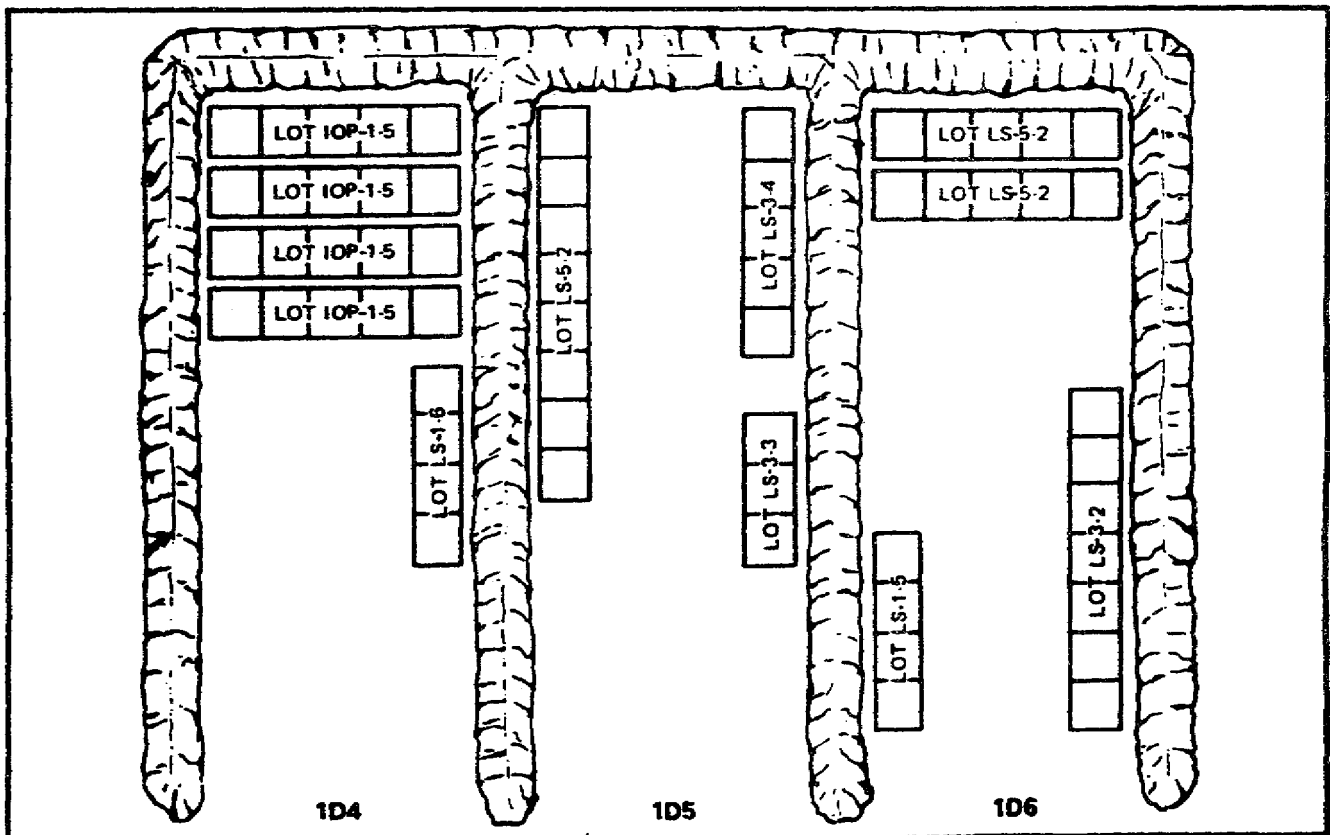


Figure 3-6. Rewarehousing Situation.



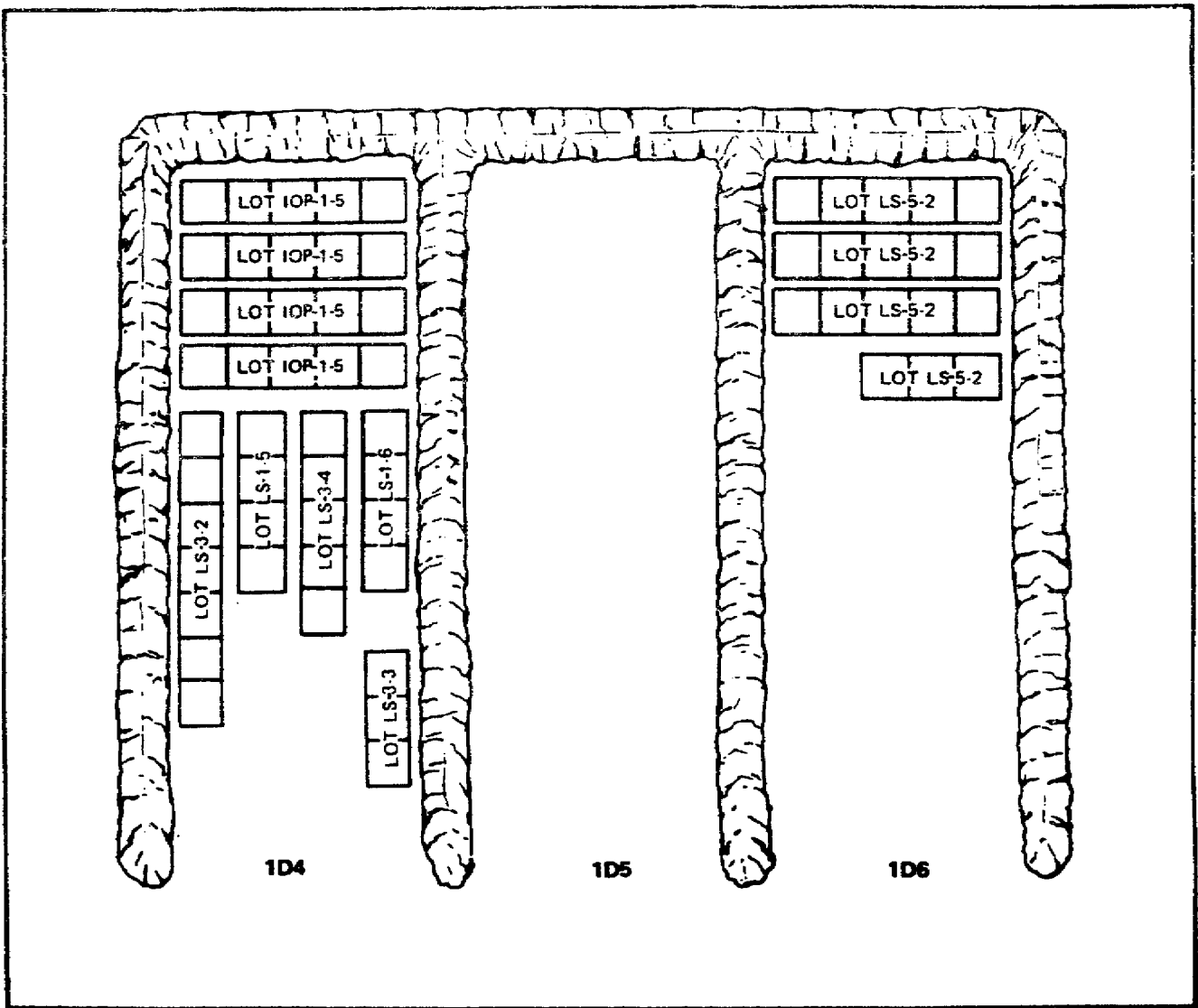


Figure 3-7. Rewarehousing Solution.

### COMPLETING THE PAPERWORK

When moving ammunition from one site to another, a DA Form 3151-R was used (refer to Figure 3-1). When the move is complete, you will sign the form in both the Issuing and the Receiving Checker Blocks and will turn in the DA Form 3151-R to the stock control office. Figure 3-8 shows a completed DA Form 3151-R.

The DA Form 3020-R (Magazine Data Card) (Figure 3-9) is used whenever ammunition is moved, issued, or received. In the case of rewarehousing, any time the amount of ammunition at a site changes, the DA Form 3020-R must be filled out as shown in Figure 3-9.

AMMUNITION STORES SLIP <small>FOR USE OF THIS FORM, SEE FM 9-38. THE PROPONENT IS UNITED STATES ARMY TRAINING AND DOCTRINE COMMAND.</small>		AUTHORITY 6066-0001		DATE 6067			
FROM: Stock Control		NAME OF ACTIVITY ASP#1 Vilseck, Ger					
TO 1st Platoon		VEHICLE NO.					
RECEIPT <input type="checkbox"/>		ISSUE <input type="checkbox"/>		OTHER (SPECIFY) Rewarehouse <input checked="" type="checkbox"/>			
DRIVER							
NSN DODIC NOMENCLATURE	LOT NO.	ACC	LOCATION		PLTS -BXS	TOTAL ROUNDS	INIT
			FROM	TO			
1320-00-529-7331-D544 Proj, 155MM HE, M107	10P5-31	A	1A1	283	77 <del>80</del>	616 <del>640</del>	BB
REMARKS Rewarehouse from pad 1A1 to 283. Records show 640 rounds on 1A1.							
DATE	SIGNATURE OF ISSUING CHECKER	DATE	SIGNATURE OF RECEIVING CHECKER				
6067	SP4 Bill Baker	6067	SP4 Bill Baker				

DA FORM 3151-R REPLACES DA FORM 3151, 1 JUL 68 WHICH MAY BE USED UNTIL EXHAUSTED 1 APRIL 1976

Figure 3-8. Completed DA Form 3151-R.



STOCK NUMBER		MONUMENTATION		STOCK NUMBER		DATE PREPARED		CONTROL NUMBER								
1320-00-529-7345-0571		Projectile 155mm HE, M107, M/Suppl CHG		T SAME		6/6/67		6069-6061								
SERIAL	LOT	SITE LOCATION	GRID LOCATION	MGR	QUANTITY	MIL	UP/DN	SERIAL/LOT NUMBER	SITE LOCATION	GRID LOCATION	MGR	QUANTITY	MIL	UP/DN	SIGNATURE OF FOREMAN/CHECKER/INSPECTOR	DATE OF ACTION
JA-10-2		G90700	ACAD	A 11A B54	640	80	8	A	G90700	ACID	A 11A B54	616	77	8	514 Dick Baker	6/6/67
															SFC O Holloway	6/6/67
															CMS A J Johnson	6/6/67

REMARKS: Remove house from ACAD to ACID  
There were only 77 pcts (616 add) at ACAD

DA FORM 4508

Figure 3-10. Completed DA Form 4508 (Ammunition Transfer Record).

---

**REVIEW EXERCISES**

Circle the letter of the correct answer to each question.

1. Which of the following situations would call for a rewarehousing operation?
  - a. To place all of the same lot numbers at one storage site.
  - b. To ensure the same amount of ammunition is stored in the same section.
  - c. To make more space at the storage site.
  - d. To make sure that all small lots are placed to the rear of each storage site.
  
2. Which of the following procedures should be done first when rewarehousing loose boxes of ammunition?
  - a. Separate the boxes by size.
  - b. Place the boxes to the rear of the site.
  - c. Place the boxes in one stack.
  - d. Separate the boxes by DODIC.
  
3. Which of the following procedures is used to correct a discrepancy on a DA Form 3151-R?
  - a. Complete a new DA Form 3151-R.
  - b. Notify the supervisor.
  - c. Notify the stock control office.
  - d. Draw a line through the incorrect amount and enter the correct amount.
  
4. Which of the following procedures should be followed to make the checking of nomenclatures and lot numbers easier?
  - a. Draw a diagram showing where each lot is placed on the site.
  - b. Leave space between the lots.
  - c. Assist the person assigned to perform the job.
  - d. Make signs and place them on the stacks.
  
5. When rewarehousing palletized projectiles, which of the following materials handling equipment is best to use?
  - a. A crane.
  - b. A wrecker.
  - c. A rough-terrain forklift.
  - d. A dolly.

Recheck your answers to the Review Exercises. When you are satisfied that you have answered every question to the best of your ability, check your answers against the Exercise Solutions. If you missed one or more questions, you should retake the entire lesson, paying particular attention to the areas in which your answers were incorrect.

---

## Lesson 4 INVENTORYING AMMUNITION

---

TASK	This lesson is based on the following task from soldiers manual STP 9-55B12-SM: 093-400-1296, Inventory Ammunition.
OBJECTIVE	When you have completed this lesson, you should be able to describe the steps to perform an inventory, including completing the inventory forms
CONDITIONS	You will have this subcourse book and will work without supervision.
STANDARD	You must score at least 70 on the end-of-subcourse examination, which covers this lesson and lessons 1, 2, 3, and 5.

---

### NEED FOR INVENTORYING

ASP personnel are charged with the task of accounting for ammunition stocks stored in their facility. This task is done by ASP inventory teams. These teams must ensure that ammunition stock records are correct and up to date.

Inventory requirements begin at the stock control office of the storage facility. For the purpose of this lesson, the facility is an ASP. The accountable officer or the stock control representative determines inventory requirements.

---

### INVENTORYING PROCEDURES

The stock control personnel at the ASP office partially prepare a DA Form 2000-3 (Installation Inventory Count Card), as shown in Figure 4-1. In this example, the ammunition location and the NSN or DODIC are entered on the top line; however, follow local policy in the field. (There is more room on the second line for the NSN and DODIC.) The unit of issue may or may not be used. That also depends on the local SOP.

When supervisors receive partially prepared inventory count cards, they divide their personnel into inventory teams. Each team consists of a counter, who counts the stock, and a recorder, who performs the necessary computations and completes the inventory forms. Each inventory team may be given several inventory count cards for several different storage locations. The cards may list the same type of ammunition with a different lot number, or the types of ammunition may be entirely different on each card.

These are the steps an inventory team follows to perform an inventory:

1. Organize the inventory count cards by storage location alphabetically and numerically.
2. Go to the storage location listed on the first card and locate the stack(s) or pallet(s) of ammunition that match(es) the first inventory count card.
3. Check the markings on the boxes or on the ammunition to make sure that the NSN, DODIC, nomenclature, and lot numbers match those on the inventory count card (Figure 4-2). If the markings do not match the inventory count card, notify the supervisor or the stock control office.

1A4		1305-00-926-3930-A071		CTG 556MM BALL		0075		6300-000	
LOCATION									
COUNT QUANTITY									
LOCATION									
COUNTER AND DATE									
NUMBER OF PALLETS									
PACKAGES PER PALLET									
QUANTITY PER PACKAGE									
TOTAL QUANTITY									
RECORDER AND DATE									
ACCEPTED RECOUNT SUSPEND									
RECORDER BALANCE UNIT PRICE									
QUANTITY									
OVER SHORT									
VALUE									
OVER SHORT									
COUNT QUANTITY									

DA FORM 2000-3, 1 OCT 83  
 INC NO LCI NO SERIAL NUMBER  
 LC1 - 505

PRYOR G 0481  
 INSTALLATION INVENTORY COUNT CARD (AR 711.15)

Figure 4-1. Partially Prepared DA Form 2000-3 (Installation Inventory Count Card).

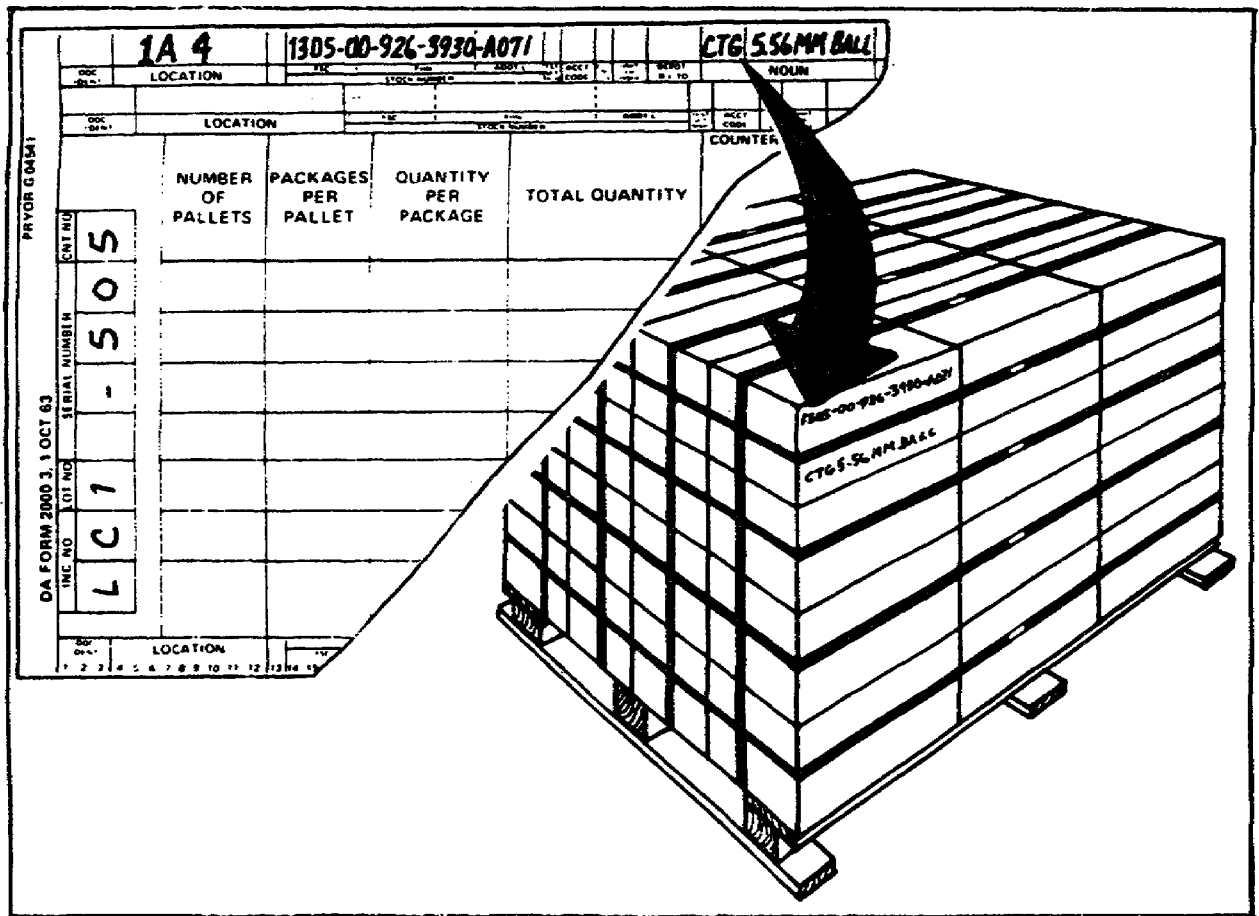


Figure 4-2. Inventory Count Card and Markings on Ammunition Boxes.

4. Count the number of full pallets. A full pallet is one that has the required number of boxes or rounds on the pallet (Figure 4-3). The DOD Consolidated Ammunition Catalog (on microfiche) can be used to determine the correct number of boxes or projectiles per pallet. Most experienced ASP personnel can recognize a full pallet easily. Full pallets should still be banded. If the bands are broken, check the pallet carefully to see if the correct number of boxes or projectiles are there. To count the boxes, count the number of boxes on the length of the pallet, count the number of boxes on the width of the pallet, and count the number of boxes in the height of the pallet. Multiply the number of boxes in length times the width times the height to get the total number of boxes. Using the example in Figure 4-3, the computation would be:

$$\begin{array}{r} 4 \text{ boxes long} \\ \times 3 \text{ boxes wide} \\ \hline 12 \\ \times 4 \text{ boxes high} \\ \hline 48 \text{ total boxes} \end{array}$$

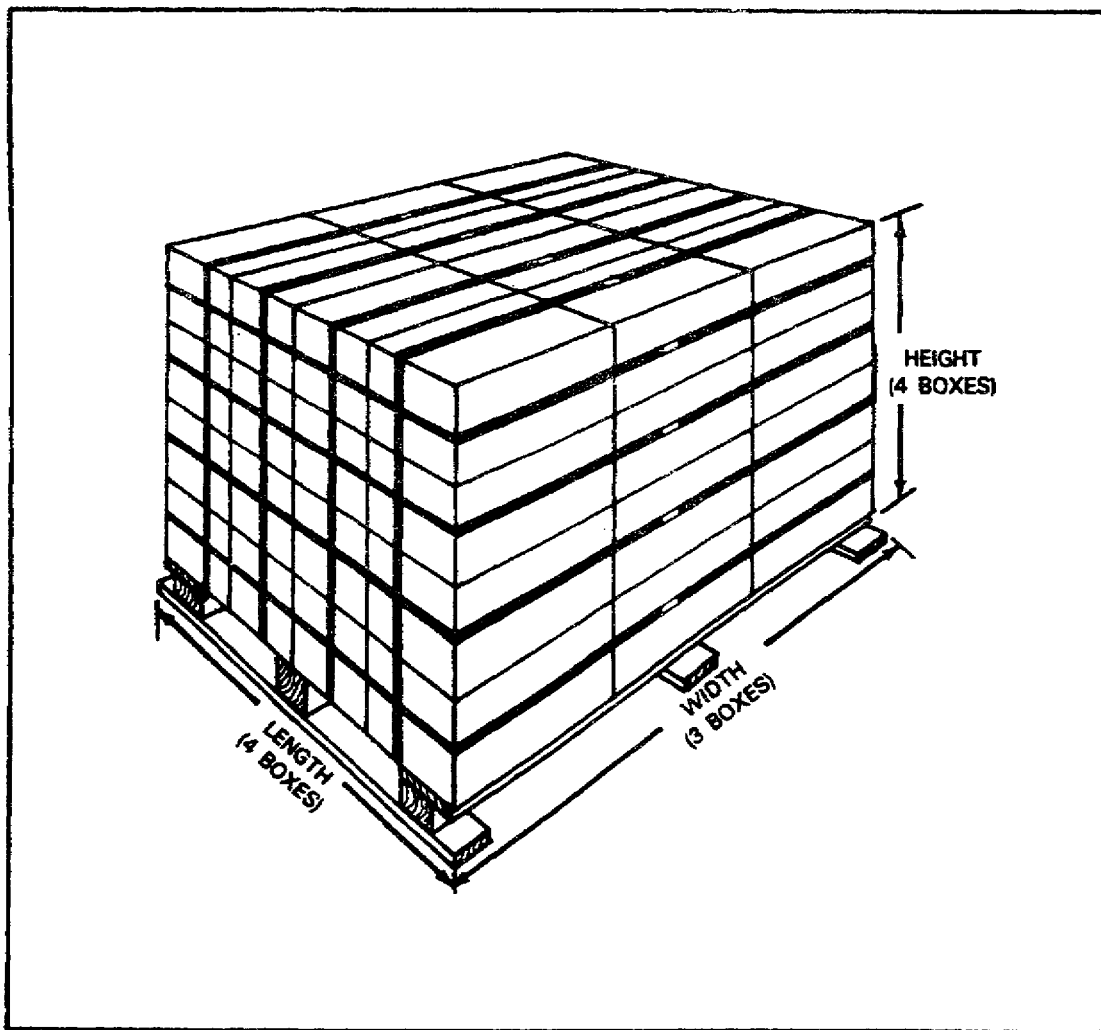


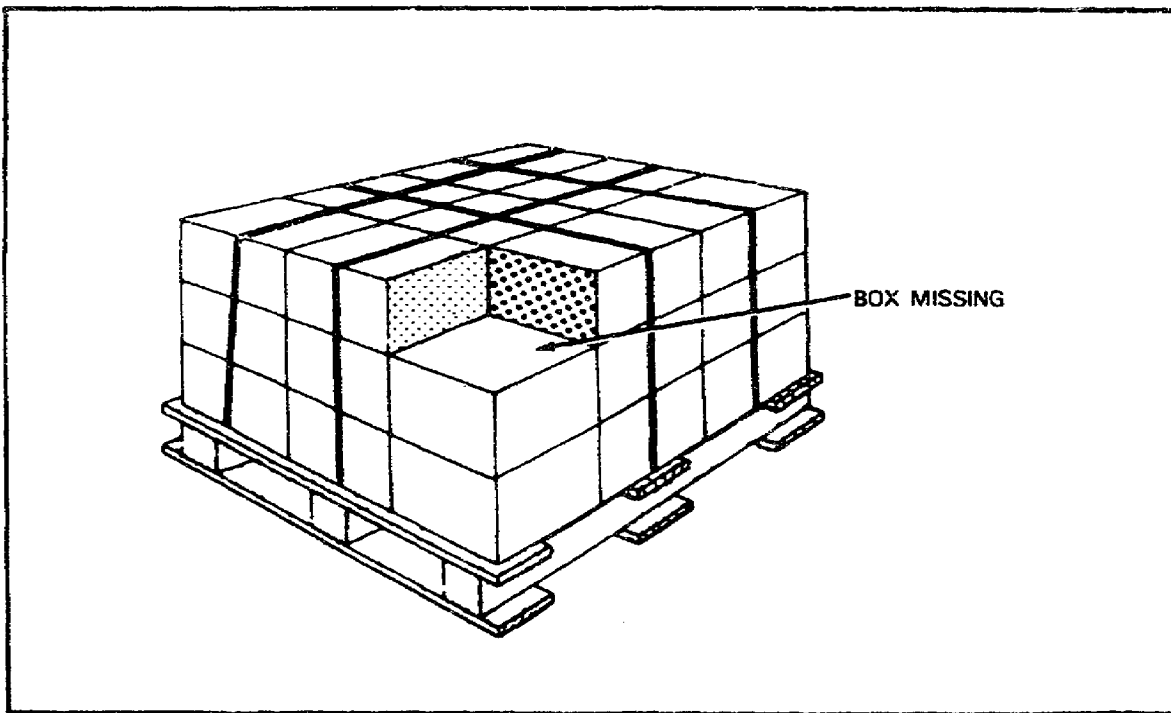
Figure 4-3. A Full Pallet of Boxed Ammunition.



**MM2601, Lesson 4**

- Count the number of light pallets. A light pallet is one from which one or more boxes or projectiles are missing (Figure 4-4). Look for the empty filler boxes that are sometimes used to complete a pallet load. They will be marked "empty." The procedure for counting a light pallet is the same as that for a full pallet, except that the number of boxes missing is subtracted to get the actual total. One box is missing from the pallet in Figure 4-4, therefore:

$$\begin{array}{r}
 3 \text{ boxes long} \\
 \times 3 \text{ boxes wide} \\
 \hline
 9 \\
 \times 3 \text{ boxes high} \\
 \hline
 27 \text{ boxes} \\
 - 1 \text{ box missing} \\
 \hline
 26 \text{ total boxes}
 \end{array}$$



*Figure 4-4. A Light Pallet of Ammunition.*

- Compute the total number of rounds. Follow the example below to see how the counter and the recorder arrive at the total number of rounds. Figure 4-5 shows 3 full pallets and 1 light pallet. The counter tells the recorder the number of full pallets, light pallets, and the number of rounds per box. In the example, there are 3 full pallets, 27 boxes per pallet, with 1,680 rounds per box. The recorder computes the total number of rounds using this formula: rounds per box times the total number of boxes (pallets times boxes per pallet) equals the total number of rounds. Therefore:

$$\begin{array}{r}
 1,680 \text{ rounds per box} \\
 \times 81 \text{ total boxes (3 pallets } \times \text{ 27 boxes per pallet)} \\
 \hline
 1680 \\
 13440 \\
 \hline
 136,080 \text{ total rounds}
 \end{array}$$

Next, the counter gives the information on any light pallets to the recorder. In this case, there is 1 light pallet, 6 boxes per pallet, with 1,680 rounds per box. The recorder then figures the amount:

$$\begin{array}{r} 1,680 \text{ rounds per box} \\ \times 6 \text{ total boxes} \\ \hline 10,080 \text{ rounds} \end{array}$$

As a double check for accuracy, the counter must also compute these amounts.

In some cases a box on a pallet may not contain the correct amount of ammunition. These are called light boxes. A light box of ammunition should be painted orange, and the exact amount of ammunition it contains should be stenciled on the box. Any time inventory team members see an open or unsealed box, they should check to see if it contains the correct amount of ammunition. They may find light boxes that are not painted orange and correctly marked.

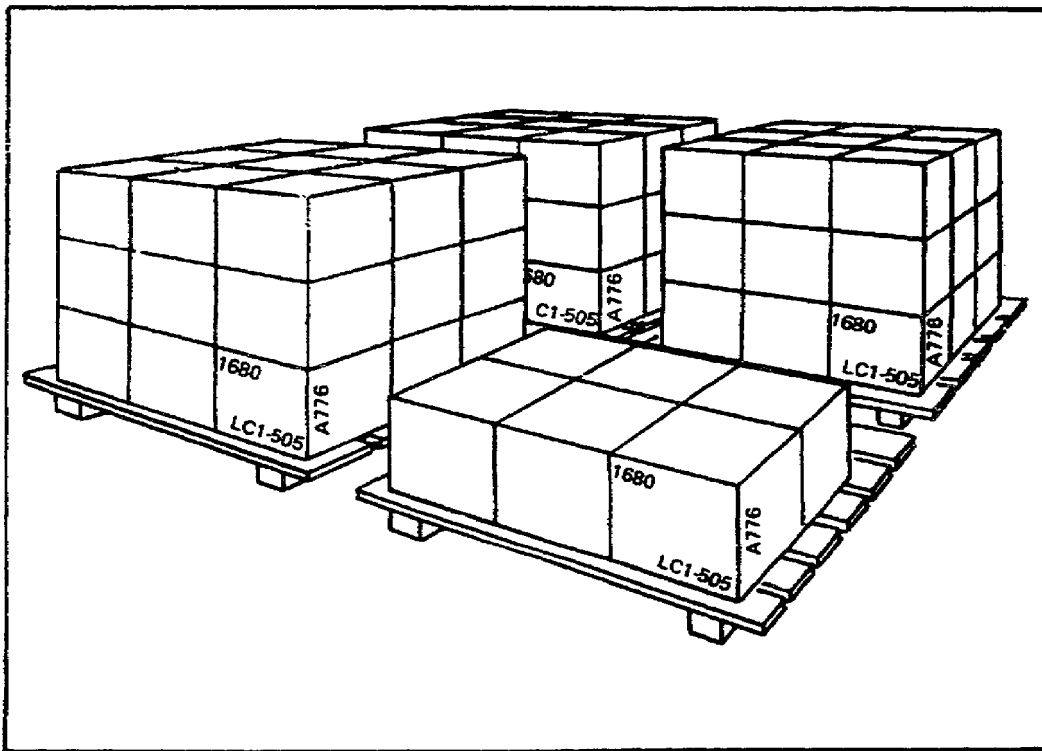


Figure 4-5. Four Pallets with the Same DODIC and Lot Numbers.

7. Enter the inventory information on the inventory count card. (Figure 4-6). The recorder totals the amounts in the Quantity Per Package Block and enters that total in the Count Quantity Block (top right-hand corner). The recorder must double-check the data on the DA Form 2000-3 and on the ammunition to ensure that the correct items are being inventoried. Any disagreement between the counter and the recorder should be resolved before completing the DA Form 2000-3.
8. Sign and date the card in the Recorder and Date Block.
9. Turn in the inventory count card(s) to the supervisor or the stock control office.

MM2601, Lesson 4

1A4		1305-00-926-3930-A071		CTG 556MM BNL		DOT5		6300 0001 146,160	
LOCATION									
LOCATION									
COUNTER AND DATE									
RECORDED AND DATE									
ACCEPTED RECOUNT SUSPEND									
RECORDED BALANCE UNIT PRICE									
QUANTITY									
OVER SHORT									
VALUE									
OVER SHORT									
LOCATION									

NUMBER OF PALLETS	PACKAGES PER PALLET	QUANTITY PER PACKAGE	TOTAL QUANTITY
3	27	1680	156,080
1	6	1680	10,080
			146,160

RECORDER AND DATE: SP4 Bill Baker, 27 Oct 86

DA FORM 2000-3, 1 OCT 83

LC1-505

INITIATION INVENTORY COUNT CARD (AR 711-16)

Figure 4-6. Completed Inventory Count Card.

- Post the DA Form 3020-R (Magazine Data Card) for each stack of ammunition, as shown in Figure 4-7, before leaving the pad. To complete the form, enter the calendar date, voucher number as shown on the inventory count card, print the word "inventory" in the Received From or the Issued To Column. Place a 0 (zero) in the Quantity Received and Quantity Issued Blocks. Enter the actual item count recorded on the inventory count card in the Balance Block. Then initial the Foreman Checker Block.

If the balance on the DA Form 2000-3 and the balance shown on the DA Form 3020-R do not agree and your inventory team is convinced that the count is correct, then take the DA Form 3020-R to the stock control office to have the issue resolved. If a magazine data card is not on the stack you have inventoried, obtain a blank DA Form 3020-R and prepare it as shown in Figure 4-7.

After the inventory is complete, the accountable officer checks the serial numbers of the DA Forms 2000-3 against the control listing. Then the recorded balance, unit price, quantity over or short, and the dollar value over or short are entered on the inventory count card. Accountable officers may accept the balance recorded on the inventory count card as correct for stock record purposes without a recount if an overage or shortage value for the item is not more than \$25.00. When this option is used, the new balance will be posted to stock records directly from the inventory count card, using the document number assigned to the control listing. If the overage or shortage is more than \$25.00, the item will be recounted by an inventory team other than the one that made the original count. The new count will be recorded on a new DA Form 2000-3.

Here is another inventory situation. Figure 4-8 shows 4 pallets of DODIC A071, Lot Number LC 1-505. Note that there are 3 full pallets and 1 light pallet with 1 light box. Follow this example of the inventory team's actions. Review the inventorying steps given earlier in this lesson, if needed. The counter tells the recorder that there are 3 full pallets, 27 boxes per pallet, with 1,680 rounds per box, 1 light pallet, 5 boxes per pallet, with 1,680 rounds per box, and 1 light box with 840 rounds in the box. The recorder enters this information on the inventory count card, as shown in Figure 4-9. Note that light boxes are entered in the Packages Per Pallet Column, Quantity Per Package Column, and the Total Quantity Column.



1A4		1305-00-926-3930-A071		CTG 556MM BALL		0015		6300-0001		145,320	
LOCATION		MOUNT		COUNT		QUANTITY		DSI		BY DATE	
LOCATION		MOUNT		COUNT		QUANTITY		DSI		BY DATE	
DA FORM 2000-3, 1 OCT 83 THE NO. LOT NO. LCT - 505 SERIAL NUMBER 1 - 505	NUMBER OF PALLETS	PACKAGES PER PALLET	QUANTITY PER PACKAGE	TOTAL QUANTITY	COUNTER AND DATE		0000000000				
	3	27	1680	156,080	RECORDER AND DATE		1111111111				
	1	5	1680	8,400	SP4 Bill Gabe		2222222222				
					27 Oct 86		3333333333				
					ACCEPTED RECOUNT SUSPEND		4444444444				
								5555555555			
								6666666666			
								7777777777			
								8888888888			
								9999999999			
				145,320	RECORDED BALANCE UNIT PRICE						
					QUANTITY						
					OVER SHORT						
					VALUE						
					OVER SHORT						

Figure 4-9. Completed DA Form 2000-3.

Here is an inventory situation that involves separate loading projectiles. Refer to the inventory count card shown in Figure 4-10. At pad B7, you find that the markings and lot number match the pallets shown in Figure 4-11. Act as both the counter and the recorder and complete the inventory count card in Figure 4-10. Compare your completed form with the inventory count card shown in Figure 4-12. Note that there are two things different on this inventory count card compared to the one for boxed ammunition items (see Figure 4-9). Instead of packages per pallet, rounds per pallet are listed and the Quantity Per Package Column is listed as not applicable (NA).

B7		1520-00-028-489-D554		PROJ 155MM HE		0016		6301-0002			
LOCATION		MOUNT		COUNT		QUANTITY		DSI		BY DATE	
LOCATION		MOUNT		COUNT		QUANTITY		DSI		BY DATE	
DA FORM 2000-3, 1 OCT 83 THE NO. LOT NO. IOP - 5-21 SERIAL NUMBER 1 - 505	NUMBER OF PALLETS	ROUNDS PER PALLET	QUANTITY PER PACKAGE	TOTAL QUANTITY	COUNTER AND DATE		0000000000				
			NA		RECORDER AND DATE		1111111111				
							2222222222				
							3333333333				
							4444444444				
								5555555555			
								6666666666			
								7777777777			
								8888888888			
								9999999999			
					RECORDED BALANCE UNIT PRICE						
					QUANTITY						
					OVER SHORT						
					VALUE						
					OVER SHORT						

Figure 4-10. DA Form 2000-3, Projectile Exercise.

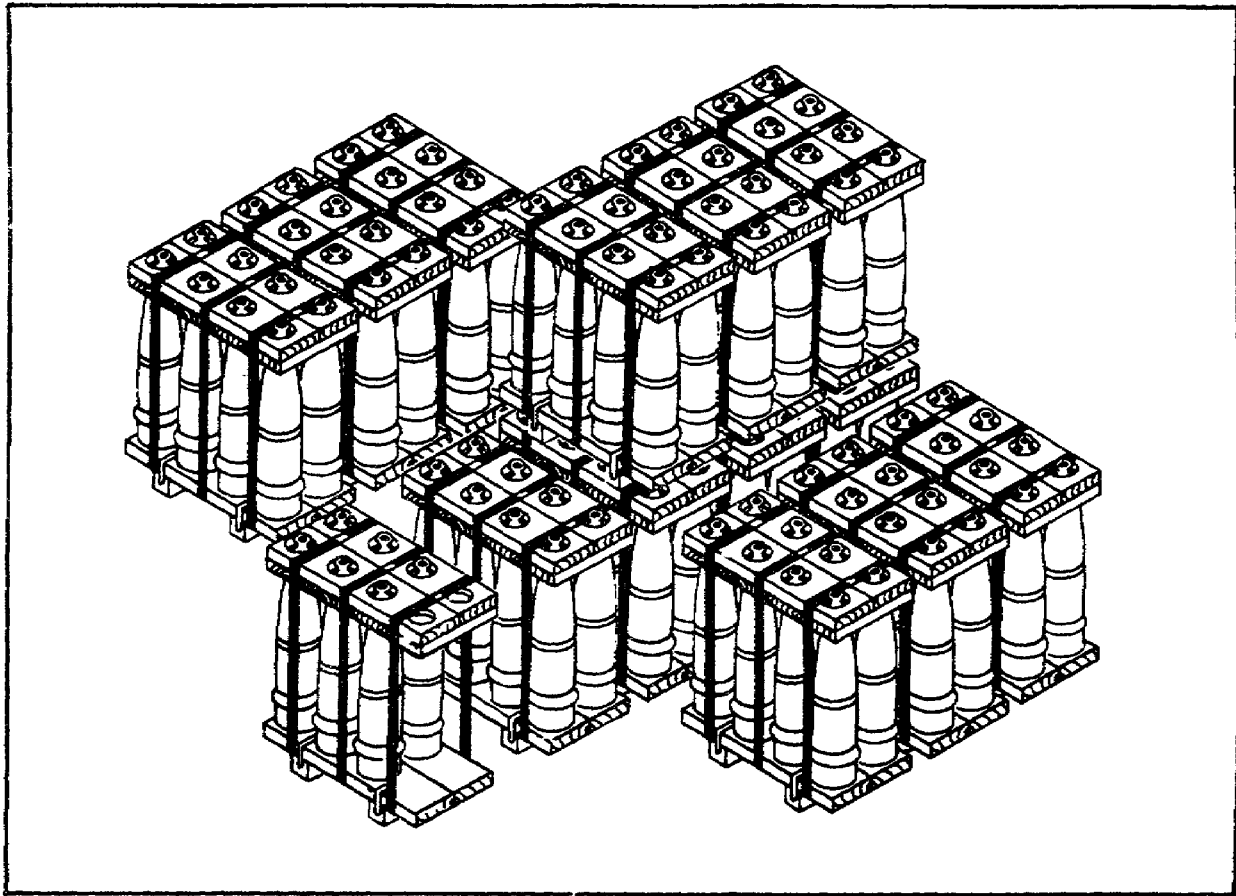


Figure 4-11. 155mm HE Projectiles.

DA FORM 2000-3, 1 OCT 83		I O P		SERIAL NUMBER		I 0 5 1 2 1		TRYOR CLASMT	
LOCATION		B7		1520-00-028-4009-0554		PROJ 155MM HE		0016	
COUNT		QUANTITY		6301-0002		110		COUNT QUANTITY	
LOCATION		NOUN		NOUN		DSI		COUNT QUANTITY	
NUMBER OF PALLETS		ROUNDS PER PALLETS		QUANTITY PER PACKAGE		TOTAL QUANTITY		COUNTER AND DATE	
13		8		NA		104		0 0 0 0 0 0 0 0 0 0	
1		6		NA		6		1 1 1 1 1 1 1 1 1 1	
RECORDER AND DATE		ACCEPTED		RECOUNT		SUSPEND		2 2 2 2 2 2 2 2 2 2	
SP4 Bill Baber		<input type="checkbox"/>		<input type="checkbox"/>		<input type="checkbox"/>		3 3 3 3 3 3 3 3 3 3	
29 Oct 86		RECORDER BALANCE		UNIT PRICE		QUANTITY		4 4 4 4 4 4 4 4 4 4	
		OVER		SHORT		VALUE		5 5 5 5 5 5 5 5 5 5	
		OVER		SHORT		VALUE		6 6 6 6 6 6 6 6 6 6	
		OVER		SHORT		VALUE		7 7 7 7 7 7 7 7 7 7	
		OVER		SHORT		VALUE		8 8 8 8 8 8 8 8 8 8	
		OVER		SHORT		VALUE		9 9 9 9 9 9 9 9 9 9	
LOCATION		NOUN		DSI		COUNT QUANTITY		INSTALLATION INVENTORY COUNT CARD (AR 711.18)	
						110			

Figure 4-12. DA Form 2000-3, Projectile Exercise Solution.

---

**LOGMARS**

There is a new system of inventorying being tried out. It is called logistics application of automated marking and reading symbols (LOGMARS). It works like a checkout counter at a grocery store where a bar code on the item is read by a scanning device that records the item and automatically reduces the inventory count by that amount. If this system becomes standard, it will be included in the curriculum for the MOSC 55B10 resident course as hands-on training.

---

**REVIEW EXERCISES**

Circle the letter of the correct answer to each question.

1. Who partially prepares the DA Form 2000-3 inventory purposes?
  - a. Stock control personnel
  - b. The NCOIC.
  - c. The accountable officer.
  - d. The checker.
2. What is the first step an inventory team performs when given an inventory count card?
  - a. Find the storage location.
  - b. Organize the inventory count cards alphabetically and numerically by location.
  - c. Locate the stacks that match the inventory count card.
  - d. Organize the inventory count cards by the type of ammunition.
3. What should be done first after arriving at the storage location?
  - a. Straighten up the stacks before counting the items.
  - b. Count the items and record the findings on the inventory count card.
  - c. Check the markings on the boxes or on the ammunition to make sure that the NSN, DODIC, nomenclature, and lot numbers match those on the inventory count card.
  - d. Decide which inventory crew member will serve as the counter.
4. What should you do if the markings on the ammunition do not match the DA Form 2000-3 card?
  - a. Change the count card markings to match the actual markings.
  - b. Move to the next location.
  - c. Notify the supervisor or the stock control office.
  - d. Enter not applicable (NA) on the inventory count card.

5. After completing an inventory at a site, what is placed in the Quantity Received and the Quantity Issued Blocks of the DA Form 3020-R?
  - a. NA.
  - b. The amount inventoried.
  - c. Zeros.
  - d. Leave them blank.

Recheck your answers to the Review Exercises. When you are satisfied that you have answered every question to the best of your ability, check your answers against the Exercise Solutions. If you missed one or more questions, you should retake the entire lesson, paying particular attention to the areas in which your answers were incorrect.



**Lesson 5**  
**SELECTING AND USING**  
**AMMUNITION STORAGE DRAWINGS**

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TASK	This lesson is based on the following task from soldier's manual STP 9-55B12-SM: 093-400-2133, Select and Use a Storage Drawing for Ammunition.
OBJECTIVE	When you have completed this lesson, you should be able to select and use ammunition storage drawings.
CONDITIONS	You will have this subcourse book and will work without supervision.
STANDARD	You must score at least 70 on the end-of-subcourse examination, which covers this lesson and lessons 1, 2, 3, and 4.

---

**AMMUNITION STORAGE DRAWINGS**

Ammunition storage drawings are used to determine the correct method of storing ammunition in magazines. They show the proper placement of ammunition and indicate the total amount that may be stored in each type and size of magazine. Ammunition storage drawings provide for the maximum use of space, ensure that correct stacking methods are used, and show the correct dunnage to be used.

There are two types of ammunition storage drawings, single item and consolidated. The single item storage drawing applies to one specific item according to the way it is packed. The consolidated storage drawing applies to many different sizes of ammunition with similar outside packing (boxes or containers).

**Cover Page**

The cover page of an ammunition storage drawing (Figure 5-1) gives information about the drawing. It contains the title, the index, and the title block.

**Title.** The title gives the type of drawing (storage, outloading, or ammunition) and how it is packed. On the cover page in Figure 5-1, the title is "Storage in 60' and 80' Igloo Magazines, 80' Stradley Magazines, and Standard Magazines of Separate Loading Projectiles, Palletized."

**Index.** The index lists the contents of the drawing and the page or pages where the information is located.

**Title Block.** The title block, at the bottom of the cover page, shows:

1. What revisions of the drawing there have been, if any. (There have been no revisions for the drawing in Figure 5-1.)
2. The class—19. (The number "19" is always assigned to ammunition.)
3. The division—48. (The number "48" is always assigned to ammunition.)

# STORAGE IN 60' & 80' IGLOO MAGAZINES, 80' STRADLEY MAGAZINES, AND STANDARD MAGAZINES OF SEPARATE LOADING PROJECTILES, PALLETIZED

INDEX

<u>ITEM</u>	<u>PAGE(S)</u>
GENERAL NOTES, AND MATERIAL SPECIFICATIONS-----	2
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IGLOO STORAGE PROCEDURES	
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175MM PROJECTILE, 6/PALLET-----	6,7
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STANDARD MAGAZINE STORAGE PROCEDURES	
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8" PROJECTILE, 6/PALLET-----	30,31
MULTIPLE LOT STORAGE REQUIREMENTS-----	32

THIS DRAWING SUPERSEDES DRAWINGS  
19-48-4003-1PE1000, DATED 11 MAY  
1953, AND  
19-48-4002-2PE1000, DATED 11 MAY  
1953 AND THE REVISIONS THERETO.

DO NOT SCALE

REVISIONS		DRAFTSMAN	PROJ ENG
		MLN	mwd
		CHECKED RSH	LOG ENGRG OFFICE Smith
		APPROVED Ephraim M. Smith US ARMY MUNITIONS COMMAND	
		APPROVED BY ORDER OF COMMANDING GENERAL U S ARMY MATERIEL COMMAND Paul J. Bennett USAMC AMMO CENTER	
		U. S. ARMY MATERIEL COMMAND	
		APRIL 1973	
		CLASS	DIVISION
		19	48
		DRAWING	PKT
		4102	1-2-14 PE1001

Figure 5-1. Cover Page of Storage Drawing PE1001.

**MM2601, Lesson 5**

4. The drawing—4102 in the example. (The drawing numbers "100" through "4999" are assigned to conventional ammunition.) Guided missiles are usually assigned the numbers "5000" through "5999." Nuclear weapons are usually assigned the numbers "6000" through "6999."
5. The first group of numbers, the File—1-2-14 PE1001 in the example, shows the type of loading or the type of magazine; 1 is for igloo, 2 is for standard magazine, and 14 is Stradley magazine. A table identifying these numeric designators is given in Figure 5-2. The alphabetic designator gives the package or type of ammunition; P is for palletized or unitized, and E is for separate loading projectiles. The alphabetic designators are identified in the table in Figure 5-3. The last group of numbers, 1001 in the example, is the sequence number. It identifies the specific drawing in a numerical sequence. The type of packaging or the type of ammunition codes selected for a drawing will be the minimum required for clarity. Identification by all of the combinations involved is not required. Some examples of drawing identification methods are given in Figure 5-4.

**General Notes**

The general notes (Figure 5-5) are normally found on page 2, the back of the cover sheet. Always read the general notes, for they give all the technical data required to store the ammunition.

**DA Pam 75-5**

**Table 1. Numeric Designators**

Numeric Designator	Magazine or type of loading	Numeric Designator	Magazine or type of loading
1	IGLOO OR ARCH-TYPE MAGAZINE	12	STOREHOUSE, LIQUID PROPELLANT, GROUP 11
2	STANDARD ABOVE-GROUND MAGAZINE	13	STOREHOUSE, LIQUID PROPELLANT, GROUP 1
3	BOX TYPE MAGAZINE	14	STRADLEY MAGAZINE
4	CORBETTA MAGAZINE	15	TRAILER-ON-FLAT-CAR (TOFC) AND CONTAINER-ON-FLAT-CAR (COFC)
5	CARLOADING (RAIL)	16	PORTABLE CONTAINER FILLING
6	SMOKELESS POWDER MAGAZINE	17	TACTICAL VEHICLE
7	SMOKELESS POWDER MAGAZINE W/O CENTER POSTS	18	SHIPLOADING
8	HE (HIGH EXPLOSIVES) MAGAZINE	20	OVERPACK OR UNITIZING
10	WAREHOUSE	22	OVAL-ARCH MAGAZINE
11	TRUCKLOADING		

**1-2**

Figure 5-2. Extract from DA Pam 75-5, Table 1, Numeric Designators.

DA Pam 75-5		DA Pam 75-5	
Table 2. Alphabetic Designators			
Alphabetic Designator	Package or type of ammunition	Alphabetic Designator	Package or type of ammunition
A	BOXED	LS	LAND COMBAT SUPPORT
B	BOMB	MS	MULTIPLE SYSTEM (APPLICABLE TO MORE THAN ONE MISSILE/ROCKET SYSTEM)
C	CRATED	MT	MULTITEST SUPPORT
D	BUNDLED	NH	NIKE HERCULES MISSILE
E	SEPARATE-LOADING PROJECTILES	PA	PATRIOT MISSILE
F	METAL DRUMS	PR	PERSHING MISSILE
H	PORTABLE CONTAINER	RE	REDEYE MISSILE
J	METAL CONTAINER W/SKIDS	RO	ROLAND MISSILE
K	PLASTIC CONTAINER	RS	MULTIPLE LAUNCH ROCKET SYSTEM
M	MIXED OR METAL PACKAGES	SB	ATM-22B AND AGM-22B MISSILE
N	FIBERBOARD DRUMS	SG	SERGEANT MISSILE
P	PALLETIZED OR UNITIZED	SH	SHILLELAGH MISSILE
Q	ALL TYPES OF PACKAGES/AMMUNITION	SL	SLUFAE (SURFACE LAUNCHED UNIT FUEL AIR EXPLOSIVE)
AD	AADCP (ARMY AIR DEFENSE COMMAND POST)	SN	SPARTAN MISSILE
CH	CHAPARRAL MISSILE	SR	STINGER MISSILE
DR	DRAGON MISSILE	SS	BOTH SAFEGUARD MISSILES
EN	ENTAC MISSILE	ST	SPRINT MISSILE
FA	FORWARD AREA ALERT RADAR	TD	TARGET MISSILE AND DRONES
HA	HAWK MISSILE	TO	TOW MISSILE
HF	HELLFIRE	VP	VIPER
HJ	HONEST JOHN ROCKET		
LC	LANCE MISSILE		
LJ	LITTLE JOHN ROCKET		

1-2

Figure 5-3. Extract from DA Pam 75-5, Table 2, Alphabetic Designators.

DA Pam 75-5		DA Pam 75-5	
<b>B. Drawing identification methods.</b>			
<b>(1) Example—Conventional ammunition:</b>			
Class	Division	Drawing	File
19	48	4009	5A1000
Note: Under "File" in the example above, the number "5" indicates a carloading drawing; the letter "A" further identifies the commodity as being packed in boxes; the number "1000" identifies the specific drawing in a numerical sequence.			
<b>(2) Example—Guided missile ammunition:</b>			
Class	Division	Drawing	File
19	48	5194	GM1-14RE1
Note: Under "File" in the example above, the letters "GM" indicate guided missile ammunition; the numbers "1-14" indicate an igloo and straddle magazine drawing; the letters "RE" further identify the item as REDEYE missile ammunition; the number "1" identifies the specific drawing in a numerical sequence.			
<b>(3) Example—Nuclear weapons ammunition:</b>			
Class	Division	Drawing	File
19	45	6206	SW11E6
Note: Under "File" in the example above, the letters "SW" indicate nuclear weapons ammunition; the number "11" indicates a truckloading drawing; the letter "E" further identifies the item as separate-loading projectiles; and the number "6" identifies the specific drawing in a numerical sequence.			

1-1

Figure 5-4. Extract from DA Pam 75-5, Drawing Identification Methods.

GENERAL NOTES

- A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AMCR 740-13, AND AUGMENTS TM 743-200-1 (CHAPTER 5).
- B. NOTICE: EXPLOSIVES MAY BE STORED IN MAGAZINES TO 500,000 POUNDS PROVIDING COMPLIANCE WITH AMCR 385-100 CHAPTER 17 IS MAINTAINED. SEE NOTE J BELOW.
- C. STORED PALLET UNITS MUST NOT CONTACT THE WALLS OF A MAGAZINE. TO PROVIDE FOR THIS MANDATORY CLEARANCE REQUIREMENT, UNITS MAY BE ELIMINATED FROM THE DEPICTED STORAGE PATTERN AS NECESSARY.
- D. AISLE DIMENSIONS SHOWN FOR STORAGE PROCEDURES IN IGLOO AND STRADLEY MAGAZINES MAY BE ADJUSTED TO SUIT LOCAL CONDITIONING, VARIATIONS IN PALLET UNIT DIMENSIONS, AND/OR AVAILABLE MATERIALS HANDLING EQUIPMENT. AISLE SPACING FOR PROJECTILE STORAGE IN STANDARD ABOVE-GROUND MAGAZINES MUST COMPLY WITH NOSE TO NOSE AND BASE TO BASE DISTANCE REQUIREMENTS SPECIFIED ON PAGE 13.
- E. STORAGE PROCEDURES FOR PROJECTILE PALLET UNITS IN STANDARD ABOVE-GROUND MAGAZINES, AS DEPICTED ON PAGES 13 THRU 23, REQUIRE THE USE OF A SPECIAL TURNING ATTACHMENT ON THE FORKLIFT TRUCK FOR HANDLING AND STACKING THE UNITS. FOR DETAILS OF THE TURNING ATTACHMENT, AUXILIARY PARTS, AND PROCEDURES FOR ITS OPERATION AND USE, SEE DRAWINGS NO. D-ORDJU-1361 AND 1362, C-ORDJU-1069, AND 19-48-1221-5P9.
- F. THE MAXIMUM FLOOR LOAD FOR A MAGAZINE AS PRESCRIBED BY LOCAL STANDARDS WILL NOT BE EXCEEDED.
- G. STORAGE OF MULTIPLE LOTS IN A MAGAZINE, AS TYPICALLY SHOWN ON PAGES 12 AND 32, WILL REQUIRE CAREFUL PREPLANNING SO AS TO INSURE MHE ACCESSIBILITY TO ANY LOT. FOR MULTIPLE LOT STORAGE IN STANDARD ABOVE-GROUND MAGAZINES, SEE SPECIAL NOTE 8 ON PAGE 13.
- H. DUNNAGE LUMBER SPECIFIED THROUGHOUT THIS PROCEDURAL DRAWING IS OF NOMINAL SIZE. FOR EXAMPLE, 2" x 4" MATERIAL IS ACTUALLY 1-1/2" THICK BY 3-1/2" WIDE OR 1-5/8" THICK BY 3-5/8" WIDE.
- J. STORAGE OF SOME SPECIFIC TYPES OF SEPARATE LOADING PROJECTILES MUST ALSO COMPLY WITH CURRENT DIRECTIVES AND REGULATORY REQUIREMENTS OTHER THAN AS SPECIFIED IN THIS DRAWING.

MATERIAL SPECIFICATIONS

LUMBER ---- SEE TM 743-200-1, DUNNAGE LUMBER.  
 FED SPEC MM-L-751.

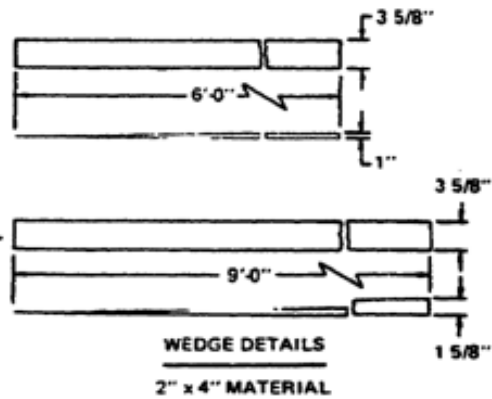


Figure 5-5. Extract from Storage Drawing PE1001, General Notes.

### Details of Units

The details of units page (Figure 5-6) gives the information about the quantity per pallet (if applicable) and the dimensions of the item to be stored.

### Storage Procedure Drawings

The remainder of an ammunition storage drawing consists of the storage procedure drawings. The index on the cover page lists storage procedure drawings by the type of storage facility to be used and, under that heading, the type of ammunition to be stored. The storage procedure drawings give the specific information needed to store ammunition.

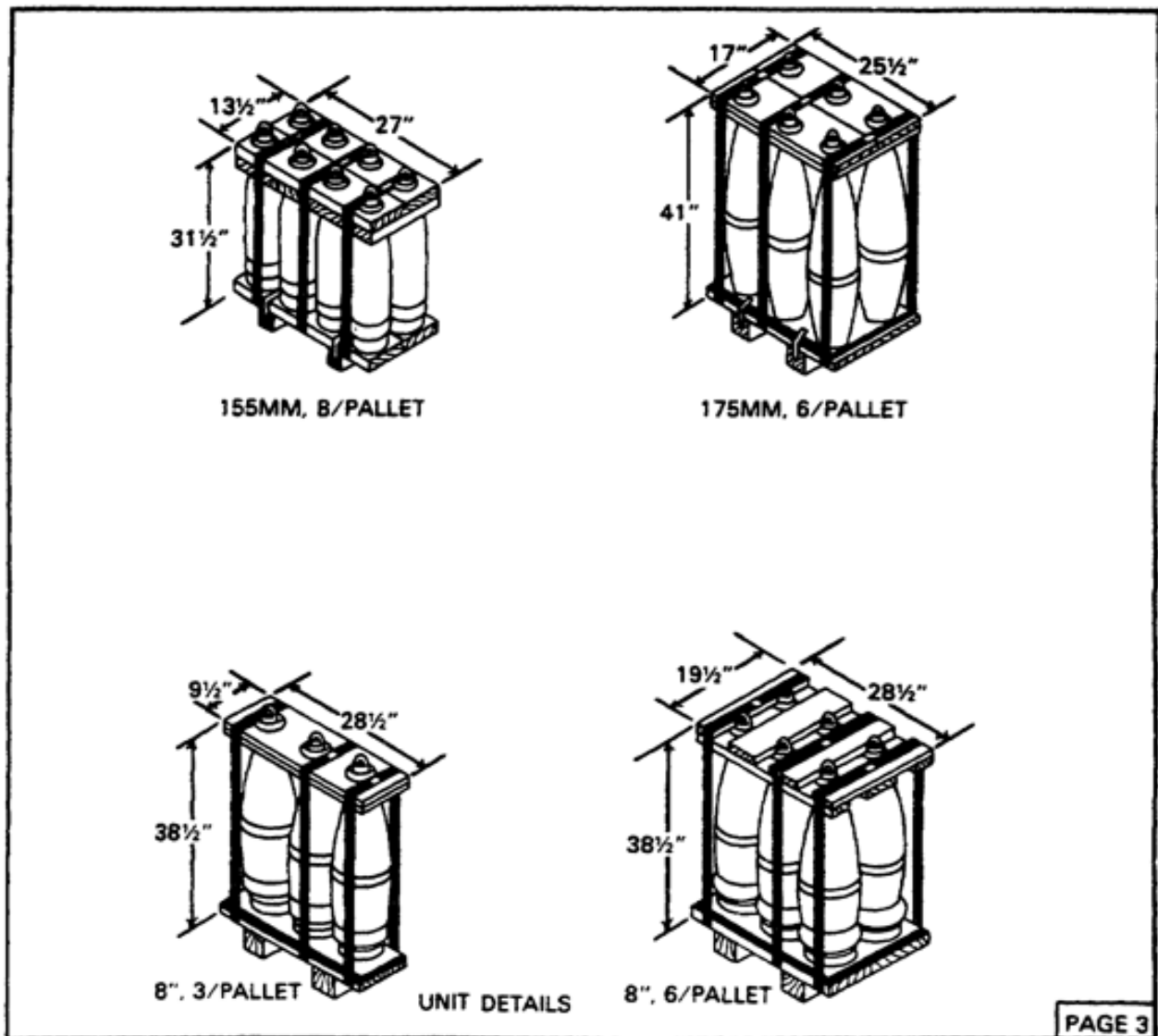


Figure 5-6. Extract from Storage Drawing PE1001, Page 3, Details of Units.

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**AMMUNITION STACKS AND BOX POSITIONS**

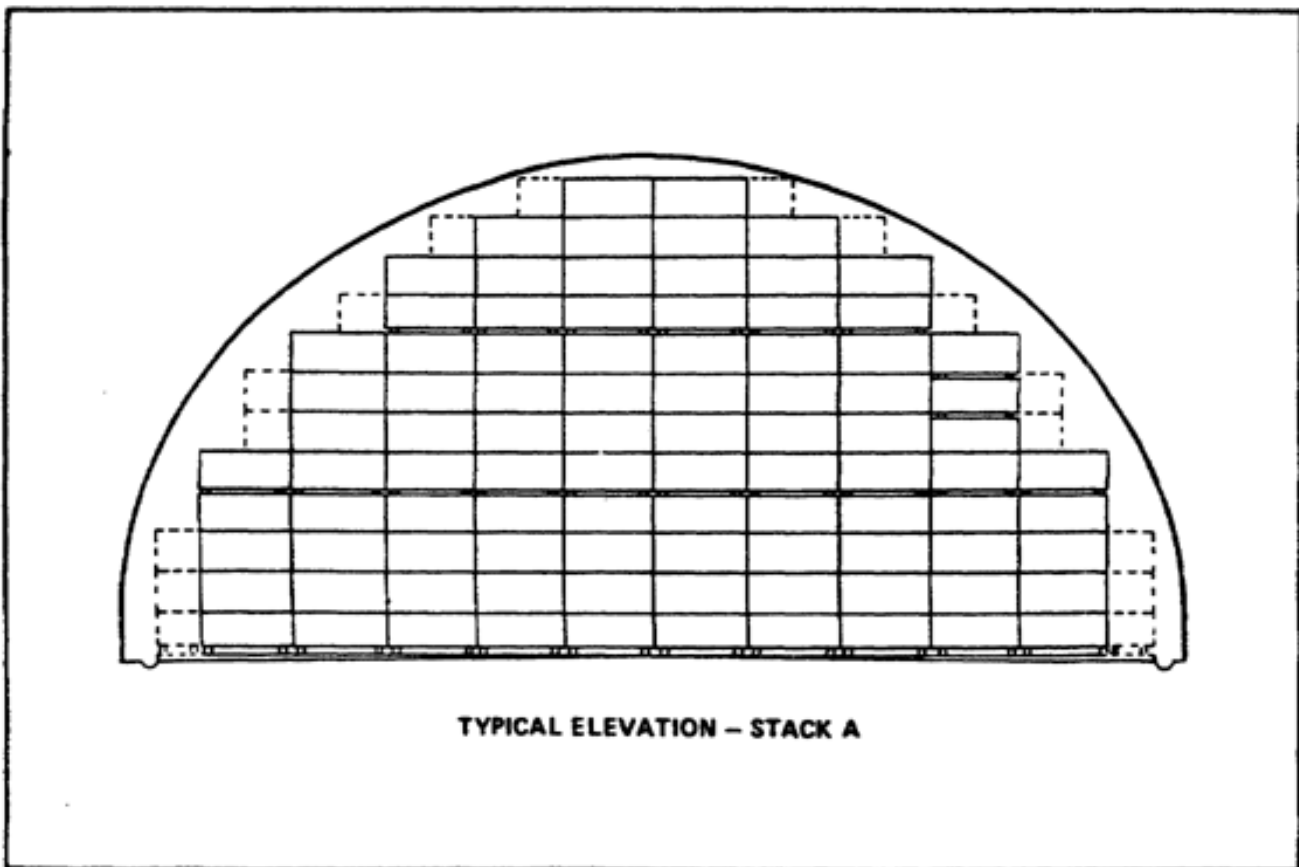
Storage drawings will refer to various types of ammunition stacks and box positions. These ammunition stacks and box positions are described below.

**Ammunition Stacks**

There are three types of ammunition stacks: A Stacks, B Stacks, and C Stacks. The A Stack has no aisle (Figure 5-7). The B Stack has an aisle in the center of the magazine (Figure 5-8). The C Stack has an aisle that is one box to the right or left of the center (Figure 5-9). C1 means to the left of center, and C2 means to the right of center.

**Box Positions**

When you have unpalletized boxed ammunition to store, there are three possible box positions: 1, 2, and 3. In box position 1 (Figure 5-10), cleated boxes are placed with the cleats (and the width of the box) parallel to the side wall. In box position 2 (Figure 5-11), uncleated boxes are placed with the box length parallel to the side wall. In box position 3 (Figure 5-12), uncleated boxes are placed with the width parallel to the side wall.



*Figure 5-7. Extract from Storage Drawing 1A1000, Page 3, Typical Elevation – Stack A.*

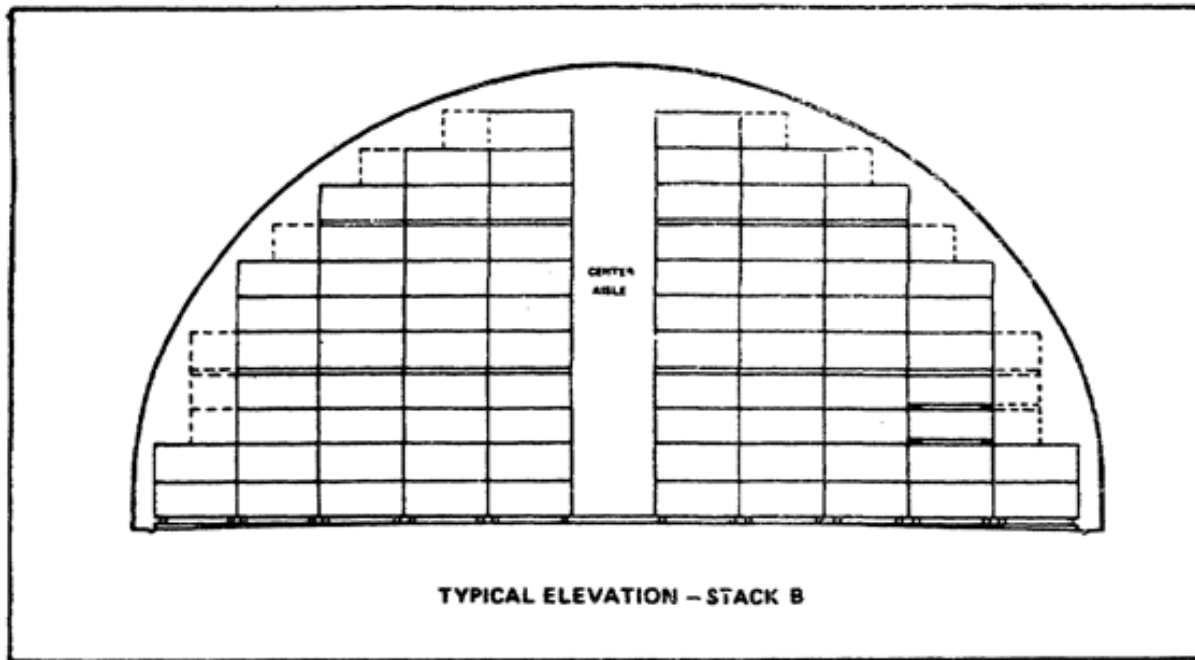


Figure 5-8. Extract from Storage Drawing 1A1000, Page 3, Typical Elevation - Stack B.

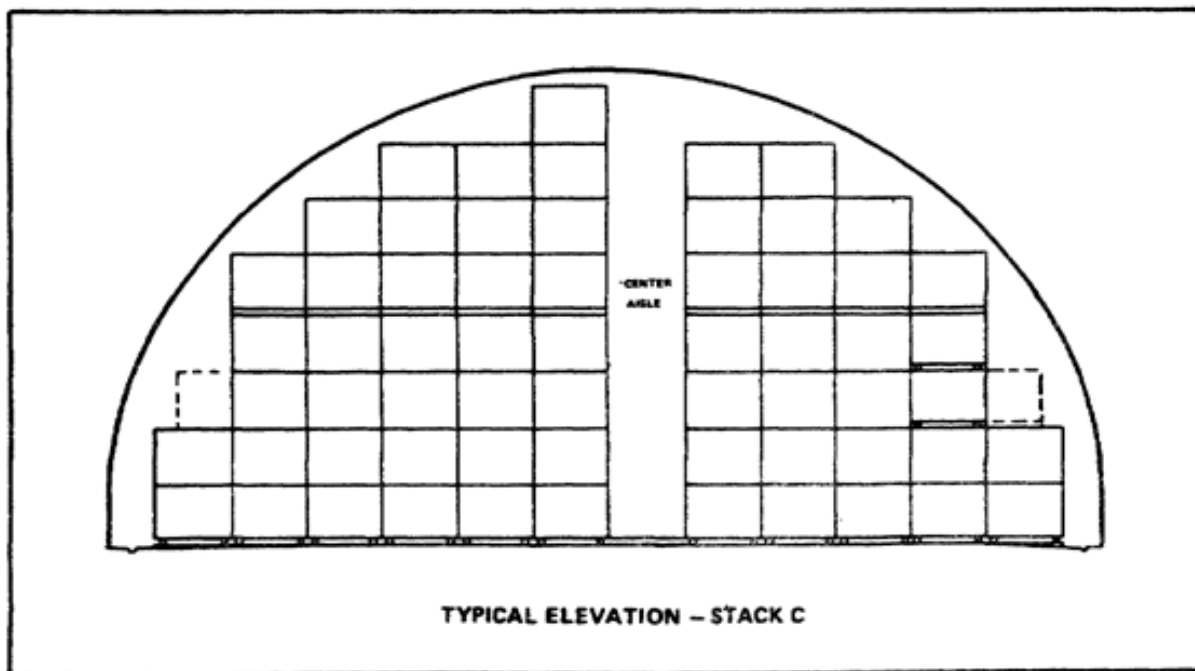


Figure 5-9. Extract from Storage Drawing 1A1000, Page 4, Typical Elevation - Stack C.



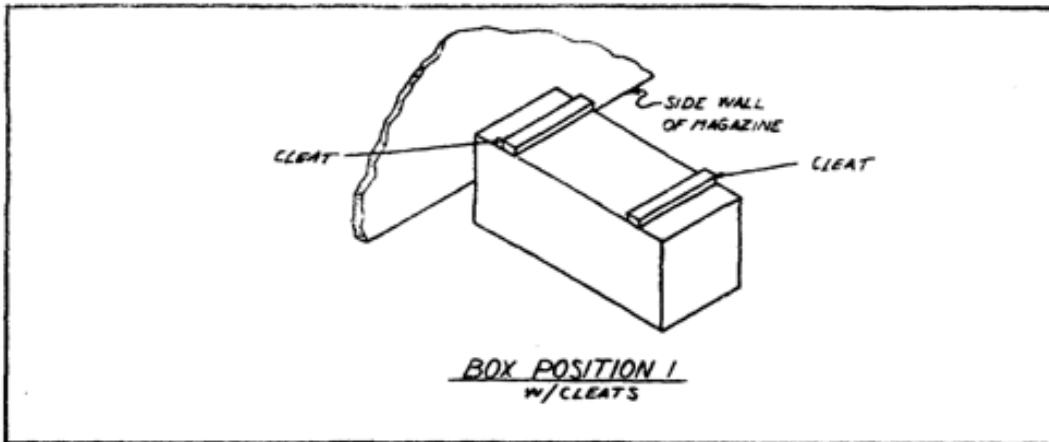


Figure 5-10. Extract from Storage Drawing 1A1000, Page 4, Box Position 1.

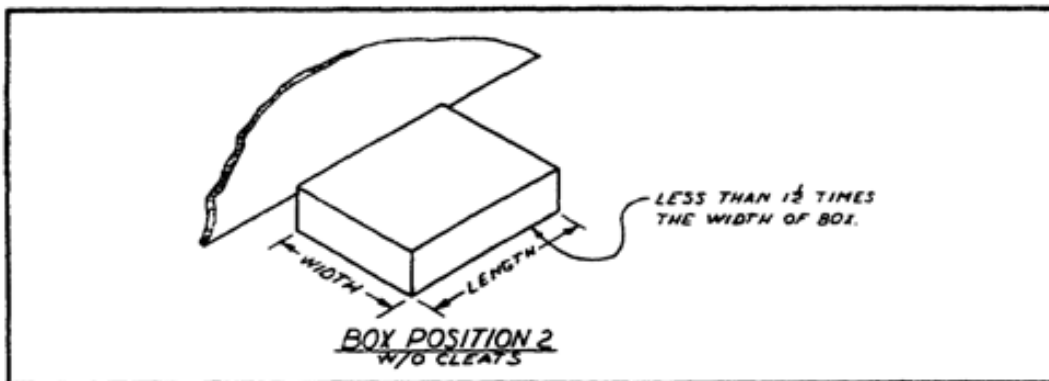


Figure 5-11. Extract from Storage Drawing 1A1000, Page 4, Box Position 2.

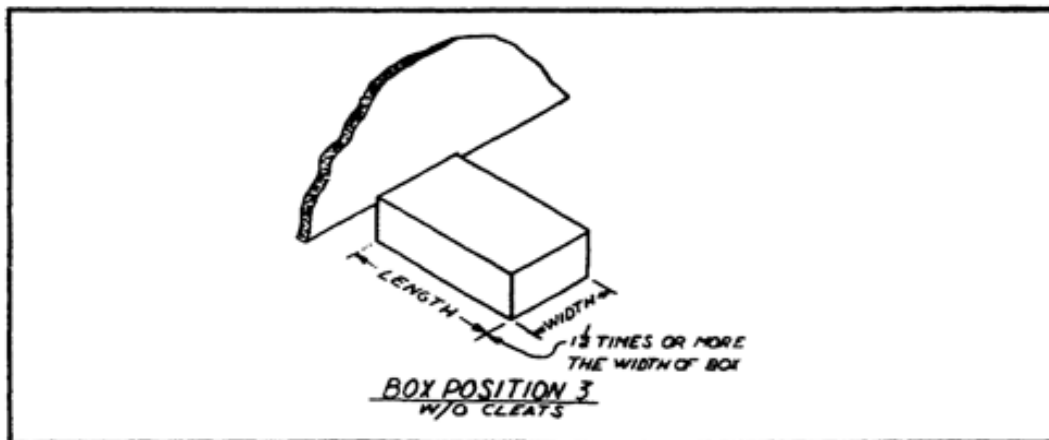


Figure 5-12. Extract from Storage Drawing 1A1000, Page 4, Box Position 3.

## USING AMMUNITION STORAGE DRAWINGS

Say that you have to store 155mm projectiles in an 80-foot igloo and want to use Drawing PE1001 to tell you how to do it. First, use the Index on the cover page (see Figure 5-1) and find the entry "Igloo Storage Procedures." Then find the listing 155mm Projectile, 8/Pallet" under that heading. Their storage procedure drawing are on pages 4 and 5. Go to those pages and you will find that the drawing you want is on page 4 (Figure 5-13). Before studying the storage drawing, you would read the general notes (see Figure 5-5) and the details of units (see Figure 5-6) for any special information about storing this type of ammunition.

A Stacks and C Stacks are used to store 155mm projectiles in an 80-foot igloo. The total quantity of pallets and projectiles that can be stored in an 80-foot igloo is given in the upper right-hand corner of the drawing. The total number of pallets that can be stored in an 80-foot igloo is arrived at by adding the total number of A Stack pallets and the total number of C Stack pallets. But first, the number of A Stack pallets and the number of C Stack pallets must be obtained. To get the number of A Stack pallets, multiply the number of pallet units per A Stack by the number of pallets in a single A Stack. In this case:

$$\begin{array}{r} 34 \text{ pallets per A Stack} \\ \times 60 \text{ total A Stacks} \\ \hline 2,040 \text{ total A Stack pallets} \end{array}$$

Then multiply the number of pallets in a single C Stack by the number of C Stacks. (The C Stacks have 26 pallets per row at the right front of the igloo and 8 pallets per row at the left front of the igloo. Although there is an aisle between the rows of pallets that form the C Stacks, it is still one stack of 34 pallets.)

$$\begin{array}{r} 34 \text{ pallets per C Stack} \\ \times 4 \text{ total C Stacks} \\ \hline 136 \text{ total C Stack pallets} \end{array}$$

To get the total number of projectiles that can be stored in an 80-foot igloo, multiply the total number of pallets by the number of projectiles per pallet:

$$\begin{array}{r} 2,176 \text{ total pallets} \\ \times 8 \text{ projectiles per pallet} \\ \hline 17,408 \text{ total projectiles} \end{array}$$

If you were using a 60-foot igloo to store your 155mm projectiles, you would use the drawing on page 5 of Ammunition Drawing PE1001 (Figure 5-14). Again, you would review the general notes (see Figure 5-5) and the details of units (see Figure 5-6) for any special information about storing the ammunition. The procedure drawing itself, when you study it, refers you back to the general notes for wedge details. Look at the Bill of Material table on the drawing in Figure 5-14. This shows the wedges and dunnage required for both types of stacks. There is also a special note on the drawing about how to handle and stack this type of ammunition.

The difference between the 80-foot and 60-foot igloos is in the number of pallets and projectiles that can be stored in them. A total of 12,512 projectiles can be stored in the 60-foot igloo, whereas 17,408 projectiles can be stored in the 80-foot igloo.

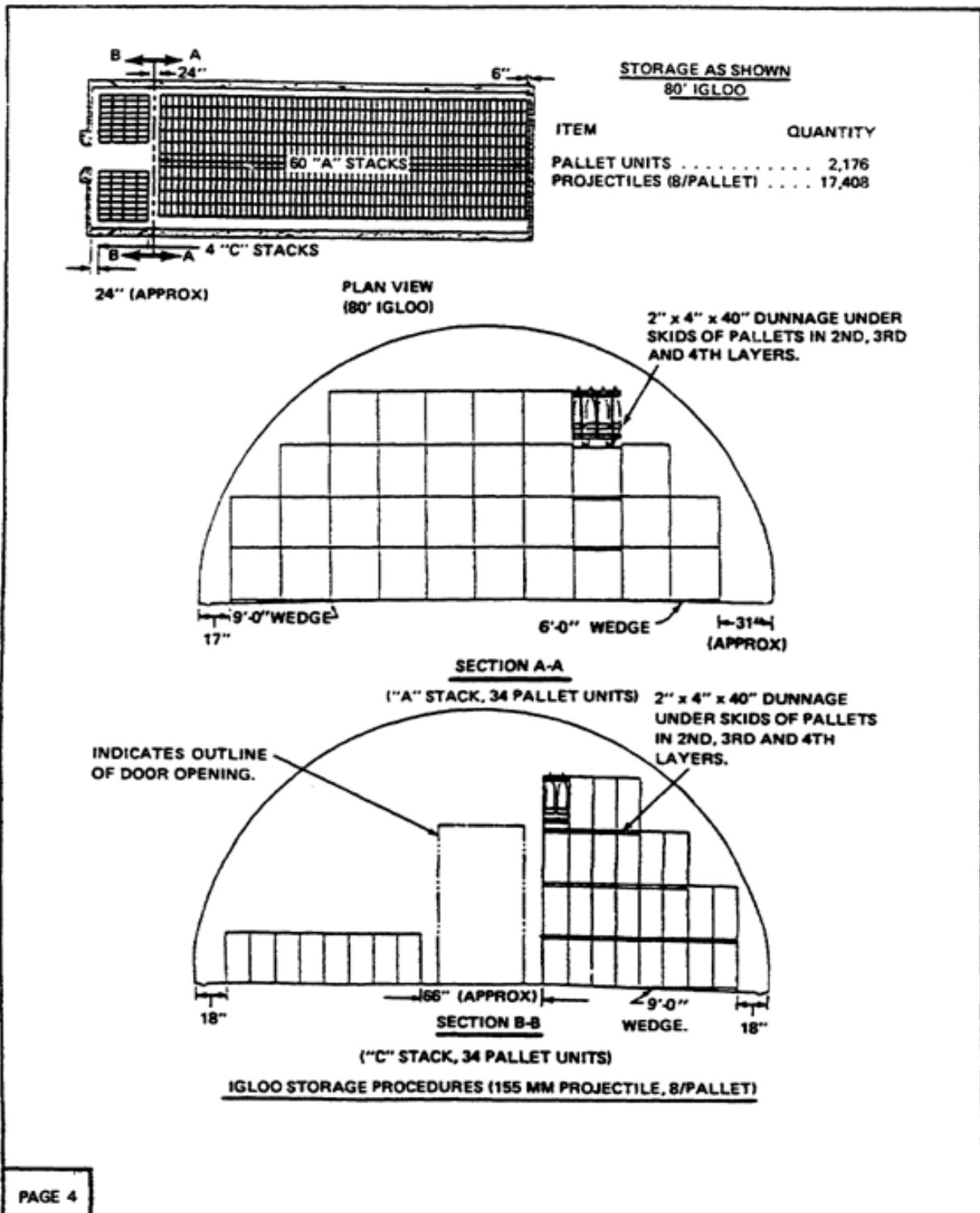


Figure 5-13. Extract from Storage Drawing PE1001, Page 4, 80-Foot Igloo Storage Procedure.

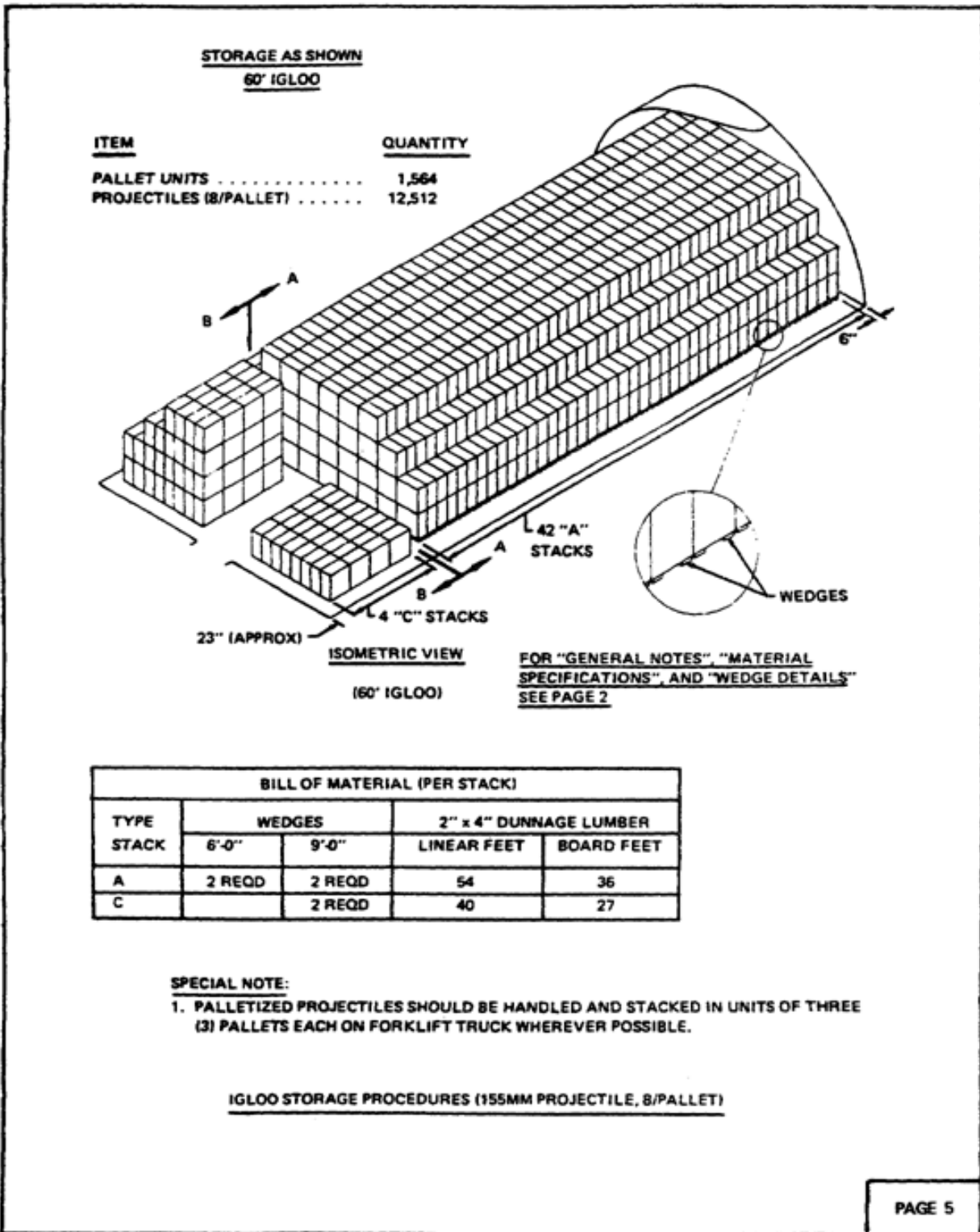


Figure 5-14. Extract from Storage Drawing PE1001, Page 5, 60-Foot Igloo Storage Procedure.

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**SELECTING AMMUNITION STORAGE DRAWINGS**

The first step in selecting the correct storage drawing is to consult the contents page of DA Pam 75-5, *List of Storage and Outloading Drawings for Ammunition* (Figure 5-15). For example, you are storing 155mm Copperhead separate loading projectiles (SLP), 1/metal container, in a Stradley oval-arch magazine. To find the correct storage drawing number, go to the Contents and look under "Conventional Ammunition." These drawings are in Chapter 3. The listing "Ammunition (thru FSC 1320)" means that Federal Supply Classes (FSC) 1305 through 1320 are found on page 3-2. According to the FSC listing below, separate loading projectiles are in FSC 1320.

<i>FSC Group Class</i>	<i>Ammunition and Explosives</i>
1305	Ammunition, through 30mm
1310	Ammunition, over 30mm up to 75mm
1315	Ammunition, 75mm through 125mm
1320	Ammunition, over 125mm
1325	Bombs
1330	Grenades
1340	Rockets, rocket ammunition, and rocket components
1345	Land mines
1350	Underwater mine inert components
1351	Underwater mine explosive components
1355	Torpedo inert components
1356	Torpedo explosive components
1360	Depth charge inert components
1361	Depth charge explosive components
1365	Military chemical agents
1370	Pyrotechnics
1375	Demolition materials
1376	Bulk explosives
1377	Cartridge and propellant actuated devices and components
1380	Military biological agents
1385	Explosive ordnance disposal tools, surface
1386	Explosive ordnance disposal tools, underwater
1390	Fuzes and primers
1395	Miscellaneous ammunition

Page 3-2 pertains to outloading drawings only, so go to page 3-3 and find the heading "Storage" (Figure 5-16). Index Number 1 (left hand column) lists the 155mm Copperhead SLP. The Stradley oval-arch magazine is in the second column to the right of the item. The correct storage drawing number for 155mm Copperhead SLP is 4160/1-3-4-14-22 PE1003. Note that the only separate loading projectiles in use by the Army at this time are 155mm and 8-inch projectiles. (There are 25.4 millimeters to an inch, so an 8-inch projectile is about 203 millimeters in diameter.)

Here is another example. To find the storage drawing number for grenades packed in palletized units (strapped), first look at the DA Pam 75-5 contents page (see Figure 5-15). Grenades are located on page 3-20. Storage drawings are on page 3-21 (Figure 5-17). The item is in Index Number 2. Since these items are to be stored in a standard magazine, the storage drawing to use is number 4118/1-2-3-4-14-22 PA1002.

Storage drawings can usually be found in the stock control office or the surveillance section.

Headquarters  
Department of the Army  
Washington, DC  
15 November 1984

Department of the Army  
Pamphlet 75-5

Explosives

List of Storage and Outloading Drawings for Ammunition

**Summary.** This pamphlet on the storage and outloading drawings for ammunition commodities and related ground support equipment is revised to include new weapon systems and revisions to existing systems. The number has been changed from DA Pamphlet 310-24 to DA Pamphlet 75-5. This change in number places it in the series which more accurately describes the contents and function. This pamphlet assists Army activities and contractors in the effective use of storage and outloading drawings to insure safe, economic, and standardized procedures for storing and transporting ammunition commodities and related ground support equipment. Major changes include new weapon systems and revision to existing systems.

**Applicability.** This pamphlet applies to all Army activities, both CONUS and OCONUS, including the Active Army, the

US Army National Guard, and the US Army Reserve, who have responsibility for storing and transporting ammunition commodities and related ground support equipment.

**Impact of New Manning System.** This regulation does not contain information that effects the New Manning System.

**Suggested Improvements.** The proponent of this pamphlet is the US Army Materiel Command. Users are invited to send comments and suggested improvements to include changes/additions to drawings, on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commander, US Army Materiel Command, ATTN: AMCSM-PST, 5001 Eisenhower Avenue, Alexandria, VA 22333-0001.

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\*This pamphlet supersedes DA Pam 310-24, 1 September 1984.

Figure 5-15. Extract from DA Pam 75-5, Contents Page.

AMMUNITION AND RELATED COMPONENTS																					
QTY	ITEM	STORAGE										SPECIAL									
		4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	4140	
	AMMUNITION (THRU FSC (320))																				
1	155MM COPERHEAD SLP 1/4 METAL CONTAINER	4140 1-3-3- 4-14-22 PE 1003	4140 1-3-3- 4-14-22 PE 1003						4140 1-3-3- 4-14-22 PW 1003	4140 1-3-3- 4-14-22 PE 1003	4140 1-3-3- 4-14-22 PE 1003							4139 20PA 1003			
2	155MM COPERHEAD WARHEADS, 5 PER METAL CNTR, 8 CNTRS/PALLET																		4176 20PA 1004		
3	BOXED AMMUNITION AND COMPONENTS (NOT PALLETIZED)	4005 1-2-3- 4-14-22 A 1000	4005 1-2-3- 4-14-22 A 1000	4005 1-2-3- 4-14-22 A 1000					4005 1-2-3- 4-14-22 A 1000	4005 1-2-3- 4-14-22 A 1000											
4	SEPARATE LOADING PROJECTILES, PALLETIZED, WITH GE OR VX FILLER	4011 - CB1-14- 22PE 1	4011 CB1-14- 22PE 1																		
5	BOXED AMMUNITION AND COMPONENTS IN PALLETIZED UNITS (STRAPPED)	4118 1-2-3- 4-14-22 PA 1002	4118 1-2-3- 4-14-22 PA 1002	4118 1-2-3- 4-14-22 PA 1002					4118 1-2-3- 4-14-22 PA 1002	4118 1-2-3- 4-14-22 PA 1002	4118 1-2-3- 4-14-22 PA 1002							4134 20PA 1002	4133 15PA 1002	4146 15PA 1003	
6	BOXED AMMUNITION AND COMPONENTS IN SADDLED UNITS (STRAPPED)	4125 1-2-3- 4-14- 22PA 1002	4125 1-2-3- 4-14- 22PA 1002	4125 1-2-3- 4-14- 22PA 1002					4125 1-2-3- 4-14- 22PA 1002	4125 1-2-3- 4-14- 22PA 1002	4125 1-2-3- 4-14- 22PA 1002							4138 20PA 1003	4133 15PA 1002	4146 15PA 1003	
7	PROPELLING CHARGES PACKED IN CYLINDRICAL METAL CONTAINERS	SEE PAGE 3-9	SEE PAGE 3-9	SEE PAGE 3-9					SEE PAGE 3-9	SEE PAGE 3-9	SEE PAGE 3-9							4043A 20PA 1001 (BASIC)	4134 15PA 1002	4146 15PA 1001	
8	COMPLETE ROUNDS PACKED IN CYLINDRICAL METAL CONTAINERS	4145 1-2-3- 4-14- 22PA 1003	4145 1-2-3- 4-14- 22PA 1003	4145 1-2-3- 4-14- 22PA 1003					4145 1-2-3- 4-14- 22PA 1003	4145 1-2-3- 4-14- 22PA 1003	4145 1-2-3- 4-14- 22PA 1003							4079 20PA 1002			
9	PALLETIZED MEDIUM CALIBER PROJECTILES (75MM THRU 125MM)																				
10	WP AND PWP LOADED AMMUNITION PACKED IN WOODEN BOXES (PALLETIZED)	4118 1-2-3- 4-14- 22PA 1002	4118 1-2-3- 4-14- 22PA 1002	4118 1-2-3- 4-14- 22PA 1002					4118 1-2-3- 4-14- 22PA 1002	4118 1-2-3- 4-14- 22PA 1002	4118 1-2-3- 4-14- 22PA 1002							4015 20PA 1004	4133 15PA 1002	4146 15PA 1002	

\* A SEPARATE LISTING OF ITEMS BY NATIONAL STOCK NUMBER AND THEIR APPLICABLE APPENDIX NUMBER ARE CONTAINED IN THE "INDEX OF APPENDICES", DRAWING 19-48-4114/9-20PA1002 FOR PALLET UNITS OR 19-48-4138/9-20PA1003 FOR SADDLED UNITS.  
 \*\* INCLUDES APPENDICES FOR SPECIFIC ITEMS.

Figure 5-16. Extract from DA Pam 75-5, Page 3-3, Ammunition and Related Components.

AMMUNITION AND RELATED COMPONENTS																										
QUANTITY	ITEM	STORAGE										WATER TRANS		SPECIAL												
		BLDG. APC <sup>1</sup> TYPE	NO.	SPRINKL. ENCL. AREA	NO.	STANDARD	NO.	WARE-HOUSE	NO.	RECT. ANNUAL	NO.	CONCRETE	NO.	EUROPEAN SHAKER	NO.	SHIP	NO.	CONCRETE	NO.	UNIFORM	NO.	COMM. CNTR.	NO.	MILITARY	NO.	
<b>GRENADES</b>																										
1	BOXED AMMUNITION AND COMPONENTS (NOT PALLETIZED)	4005 1-2-3-4 4-14-23A 1000	3	4005 1-2-3-4 4-14-23A 1000	3	4005 1-2-3-4 4-14-23A 1000	3		4005 1-2-3-4 4-14-23A 1000	3	4005 1-2-3-4 4-14-23A 1000	3														
2	BOXED AMMUNITION AND COMPONENTS IN PALLETIZED UNITS (STRAPPED)	4118 1-2-3-4 4-14-23PA 1002	1	4118 1-2-3-4 4-14-23PA 1002	1	4118 1-2-3-4 4-14-23PA 1002	1		4118 1-2-3-4 4-14-23PA 1002	1	4118 1-2-3-4 4-14-23PA 1002	1	4118 1-2-3-4 4-14-23PA 1002	1					4118 <sup>2</sup> 30PA 1002	2	4153 13PA 1002	2	4154 13PA 1002	2		
3	BOXED AMMUNITION AND COMPONENTS IN SKIDDED UNITS (STRAPPED)	4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1		4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1					4125 <sup>2</sup> 30PA 1002	2	4153 13PA 1002	2	4154 13PA 1002	2		
4	GRENADE, M33 SERIES IN WOODEN BOX, IN TYPE 1 "CONVEX"																		7025 SP M45							
5	GRENADE, M33 SERIES IN WOODEN BOX, IN TYPE 2 "CONVEX"																		7026 SP M46							
<b>DEMOLITION MATERIAL</b>																										
1	BOXED AMMUNITION AND COMPONENTS (NOT PALLETIZED)	4005 1-2-3-4 4-14-23A 1000	3	4005 1-2-3-4 4-14-23A 1000	3	4005 1-2-3-4 4-14-23A 1000	3		4005 1-2-3-4 4-14-23A 1000	3	4005 1-2-3-4 4-14-23A 1000	3														
2	BOXED AMMUNITION AND COMPONENTS IN PALLETIZED UNITS (STRAPPED)	4118 1-2-3-4 4-14-22 PA1002	1	4118 1-2-3-4 4-14-22 PA1002	1	4118 1-2-3-4 4-14-22 PA1002	1		4118 1-2-3-4 4-14-22 PA1002	1	4118 1-2-3-4 4-14-22 PA1002	1	4118 1-2-3-4 4-14-22 PA1002	1					4118 <sup>2</sup> 30PA 1002	2	4153 13PA 1002	2	4154 13PA 1002	2		
3	BOXED AMMUNITION AND COMPONENTS IN SKIDDED UNITS (STRAPPED)	4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1		4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1	4125 1-2-3-4 4-14-22 PA1002	1					4125 <sup>2</sup> 30PA 1002	2	4153 13PA 1002	2	4154 13PA 1002	2		
4	DEMOLITION KIT, PROJECTED CHARGE, M157, PACKED IN RELATED CONTAINERS	4074 1-MC 1001		4074 1-MC 1001																						
5	M173 PROJECTED CHARGE DEMOLITION KIT AND M174 PROJECTED CHARGE, WHEN PACKED IN PLYWOOD SHEATHED CRATE	4072 1-MC 1001		4072 1-MC 1001																						

<sup>2</sup> INCLUDES APPENDICES FOR SPECIFIC ITEMS.

Figure 5-17. Extract from DA Pam 75-5, Page 3-21, Ammunition and Related Components.



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**REVIEW EXERCISES**

Circle the letter of the correct answer to each question.

1. To what item and to which type storage facility does the drawing file number GM-14T0 refer?
  - a. TOW missiles in a Stradley magazine.
  - b. TOW missiles in an arch-type or Corbetta magazine.
  - c. Target missiles in a Stradley magazine.
  - d. Target missiles in an arch-type or Corbetta magazine.
  
2. To which of the following types of munitions does drawing number 6100 refer?
  - a. Guided missiles.
  - b. Conventional ammunition.
  - c. Nuclear weapons.
  - d. Chemical ammunition.
  
3. When storing 155mm separate loading projectiles in a 60-foot igloo, how many and what size wedges are required per A Stack?
  - a. To six-foot wedges.
  - b. Two nine-foot wedges.
  - c. Four six-foot wedges.
  - d. Two six-foot and two nine-foot wedges.
  
4. What is the Federal supply classification (FSC) for grenades?
  - a. 1330.
  - b. 1340.
  - c. 1370.
  - d. 1375.
  
5. What is the drawing number for demolition kits, projected charge, M157, packed in related containers stored in an arch-type igloo?
  - a. 4072 1-14C 1001.
  - b. 4044 1M 1001.
  - c. 4005 1-2-3-4-14-22A 1000.
  - d. 4116 15PA 1003.

Recheck your answers to the Review Exercises When you are satisfied that you have answered every question to the best of your ability, check your answers against the Exercise Solutions. If you missed one or more questions, you should retake the entire lesson, paying particular attention to the areas in which your answers were incorrect.

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**EXERCISE SOLUTIONS**

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**LESSON 1**

- |                               |                     |
|-------------------------------|---------------------|
| 1. c (see page 3, Figure 1-3) | 6. c (see page 2)   |
| 2. d (see page 4)             | 7. a (see page 12)  |
| 3. c (see page 6)             | 8. b (see page 12)  |
| 4. a (see page 12)            | 9. d (see page 18)  |
| 5. b (see page 14)            | 10. a (see page 18) |

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**LESSON 2**

- |   |                    |
|---|--------------------|
| 1. c (see page 22)                        | 4. a (see page 26) |
| 2. d (see pages 25 and 26,<br>Figure 2-4) | 5. b (see page 28) |
| 3. b (see page 28)                        |                    |

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**LESSON 3**

- |                    |                    |
|--------------------|--------------------|
| 1. c (see page 31) | 4. b (see page 34) |
| 2. d (see page 37) | 5. a (see page 31) |
| 3. d (see page 34) |                    |

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**LESSON 4**

- |                    |                    |
|--------------------|--------------------|
| 1. a (see page 43) | 4. c (see page 43) |
| 2. b (see page 43) | 5. c (see page 48) |
| 3. c (see page 43) |                    |

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**LESSON 5**

- |  |                    |
|--|--------------------|
| 1. a (see pages 56 and 57,<br>Figures 5-2 and 5-3) | 4. a (see page 66) |
|  | 5. b (see page 69) |
| 2. c (see page 56)                                 |                    |
| 3. d (see page 65)                                 |                    |